CATALOG

OF

WARGAMING AND MILITARY SIMULATION MODELS

11th Edition

Supersedes AD-A169472

September 1989

Force Structure, Resource, and
Assessment Directorate (J-8)
The Joint Staff
Washington, DC 20318-8000

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ABSTRACT

The 11th Edition of the *Catalog of Wargaming and Military Simulation Models* contains descriptions of 347 simulations, war games, exercises, and models in general use throughout the Department of Defense and in the defense establishments of Australia, Canada, England, and West Germany. The individual models are listed alphabetically in Appendix D by acronym (if one exists) or by long title. Each catalog entry includes the date of implementation; the proponent, point of contact, purpose, description, construction, sidedness, and limitations of the model; the improvements and modifications that are planned for the model; the input to and output of the model; the hardware, software, security classification, frequency of use, and users of the model; and general data pertaining to the time requirements of the model. The matrix of models by category, which incorporates a new system of model classification called SIMTAX, itemizes specific characteristics of each model. Consequently, the matrix enables the user of the catalog to readily find models that will fulfill particular needs.

The catalog draws upon inputs from analysis agencies in the various defense establishments, independent contractors and research organizations, and similar catalogs of games and simulations. The inclusion of a specific model in the catalog is at the discretion of its proponent and does not in any way constitute endorsement of the model by the Force Structure, Resource, and Assessment Directorate (J-8) or the Joint Staff.

Computerized simulation indexes; Military strategy; United States military forces; Theater level operations, (EDC)

FOREWORD

The 11th Edition of the Catalog of Wargaming and Military Simulation Models provides information on a number of models, simulations and war games currently in use or development. It will be especially useful to the Joint Staff, the unified and specified commands, the services, and the military operations research community.

This edition differs from the previous editions in its extensive classification system and index, which are based on the SIMTAX taxonomy. The Force Structure, Resource, and Assessment Directorate (J-8) of the Joint Staff recognized several years ago that the lack of a taxonomy hampered the creation of the descriptive framework that was needed to guide the development, acquisition, and use of models, simulations, and war games. Sharing this concern, the Military Operations Research Society (MORS) conducted a series of four workshops with J-8 to produce this useful taxonomy. The sessions were hosted by SYSCON Corporation, the systems integrators of the Modern Aids to Planning Program (MAPP). The product of these workshops was a paper soon to be published by MORS called SIMTAX: A Taxonomy for Warfare Simulation, contained in Appendix B of this catalog. Based on the SIMTAX system of model classification, the index found in Appendix C will enable the user of the catalog to scan the primary characteristics and attributes of each model and thereby to determine which models might suit his needs. In addition, the SIMTAX indexing system provides a basis for the future automation of the catalog.

Special thanks are due Ms. Sandra Weiss of SYSCON Corporation, the technical editor in charge of this edition of the catalog. Ms. Weiss was responsible for organizing, editing, and rewriting all catalog entries and she directed the final assembly of the catalog. She also created the key-word index to models based on the SIMTAX system. Because of her commitment to excellence and attention to detail, the 11th edition is both informative and easy to use.

Readers who wish to submit entries for the next edition of the catalog should review Appendix B, which provides the format to submit revisions or new entries, a blank data collection sheet, and instructions for completing the data collection sheet.

Anyone who has general comments may write to:

Force Structure, Resource, and Assessment Directorate (J-8)
The Joint Staff
The Pentagon
Rm 1D 929B
Washington, DC 20318-8000
Attention: Lieutenant Commander N. L. Hackney, USN
(202) 693-4604, AV 223-4604

TABLE OF CONTENTS

GUIDE TO MATRIX OF MODELS

MATRIX OF MODELS BY CATEGORY

INDEX ABBREVIATION KEY

PURPOSE

Function of Model

A	analysis
A–OST	analysis, operation support tool (decision aid)
A–RE	analysis, research and evaluation tool
A–RE–CD	analysis, research and evaluation tool dealing with combat development
A–RE–FCR	analysis, research and evaluation tool dealing with force capability and requirements
A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
REQ–D	required for decisions
REQ–P	required for processes
REQ–D,P	required for decisions and processes
REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

STRATEGIC WARFARE/Nuclear Exchange

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
AEM	A-RE-FCR, A-RE-WS	AB	LOC	TD	AB	CONV, CH, NUC	NR-INT	DYN-ES	DET	1
Advanced Missile...	A-RE-WS	A, L, S	GLOB	N/A	JF	NUC	REQ-I	N/A	N/A	N/A
COMET	A-RE-WS	A, SP	GLOB	A, SP	COMP	NUC	REQ-SU	STAT	N/A	1
DART Family...	A-RE-FCR	A, L, or N	LOC, REG, or TH	N/A	ELEM	CH, CONV, NUC, UNC	REQ-P	DYN-ES	DET	2-A-R
MARGI-SIOP	A-OST, A-RE-WS	A	GLOB	A, L	COMB, JF	STRAT NUC	REQ-D, P	DYN-ES	DET-EV, STO-MC	1
MEM (Multiple...)	A-RE	A, SP	GLOB	N/A	JF	STRAT NUC	NR	DYN-ES	STO-MC	2-A-1NR
MIDLAAM	A-RE-CD	A, L, S	GLOB	N/A	COMB	NUC	REQ-SU	STAT	DET-EV	1
NUC-STRATEGYST	A-RE-CD	A, L	GLOB	BAT	CONC	NUC, STRAT	REQ	DYN-TS, STAT	DET	2-A
NUCWAVE	A-RE-WS	L	GEO	CF, L	STRAT NUC	NUC	REQ-SU	STAT	DET-EV	1
RSAS	A-OST, TR-ED	A, L, S, SP	GLOB, INTRA, TH	A, L, S	COMB, JF	CONV, NUC, STRAT NUC	NR	DYN-ES, DYN-TS	DET	2-A-R
SAS	A-RE-FCR	A, L, S, SP	GLOB, TH	N/A	COMB, JF	CH, CONV, NUC	REQ	Unknown	Unknown	2-A
SEAT	A-RE-CD, FCR, WS	A, L	REG	D/N, FOR, TER, W	ELEM	CONV, NUC	REQ-I	DYN-ES, DYN-TS	DET, STO-DC	2-A
SIDAC	A	A, L	GLOB	MET, W	CONC	STRAT NUC	REQ-SU, I	DYN-TS	DET-EV, STO-MC	N/A
SINBAC	A-OST	A, L, S, SP	GLOB	L	COMP	NUC	REQ-D	DYN-ES, DYN-TS	STO-MC	2-S
SNAP	A-RE-CD	ABS		N/A	N/A	STRAT NUC	REQ-I	STAT	DET	1

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DESCRIPTION

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CO	coast
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POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
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HEX	hex-based
JU	jungles
L	land
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TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
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Time Processing

DYN	dynamic
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Treatment of Randomness

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SIDEDNESS

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NR	nonreactive
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STRATEGIC WARFARE/Nuclear Exchange (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
SPEED84	A-RE-FCR	A, L	REG	A	COMB, JF	CONV, NUC	NP	DYN-TS	STO-MC	2-A-1NR
STAM	A-OST	A, L	GLOB	A	ELEM	NUC	REQ-SU	DYN-TS	DET	1

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GEO	geographic area
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IND	individual
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INTRA	intratheater
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Environment

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EAR	earth
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FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
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Force Composition

AB	airbase
COMB	combined
CONC	conceptual
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CORPS	corps
ELEM	element
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Scope of Conflict

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KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
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STRATEGIC WARFARE/Weapons Allocation

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
Advanced Missile...	A-RE-WS	A, L, S	GLOB	N/A	JF	NUC	REQ-I	N/A	N/A	N/A
DART Family...	A-RE-FCR	A, L, or N	LOC, REG, or TH	N/A	ELEM	CH, CONV, NUC, UNC	REQ-P	DYN-ES	DET	2-A-R
MEM (Multiple...)	A-RE	A, SP	GLOB	N/A	JF	STRAT NUC	NR	DYN-ES	STO-MC	2-A-1NK
MIDLAAM	A-RE-CD	A, L, S	GLOB	N/A	COMB	NUC	REQ-SU	STAT	DET-EV	1
NUC-STRATEGYST	A-RE-CD	A, L	GLOB	BAT	CONC	NUC, STRAT	REQ	DYN-TS, STAT	DET	2-A
NUCWAVE	A-RE-WS	L	GEO	CF, L	STRAT NUC	NUC	REQ-SU	STAT	DET-EV	1
SAS	A-RE-FCR	A, L, S, SP	GLOB, TH	N/A	COMB, JF	CH, CONV, NUC	REQ	Unknown	Unknown	2-A
SEAT	A-RE-CD, FCR, WS	A, L	REG	D/N, FOR, TER, W	ELEM	CONV, NUC	REQ-I	DYN-ES, DYN-TS	DET, STO-DC	2-A
SNAP	A-RE-CD	ABS	TH	N/A	N/A	STRAT NUC	REQ-I	STAT	DET	1
STAM	A-OST	A, L	GLOB	A	ELEM	NUC	REQ-SU	DYN-TS	DET	1

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DESCRIPTION

Domain

A	air
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ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
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SECT	sector
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Environment

A	air
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BAT	battlefield
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CF	cultural features
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HEX	hex-based
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TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
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STRATEGIC WARFARE/Force Structure

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
Advanced Missile...	A-RE-WS	A, L, S	GLOB	N/A	JF	NUC	REQ-I	N/A	N/A	N/A
APM	A-RE-WS	A, L	GLOB	A, EAR	COMP	NUC	NR	DYN-ES	DET, STO-MC	2-A-1NR
Big Stick	T/E-ED	N/A	GLOB	D/N, W	COMP	STRAT NUC	REQ-P, A	DYN-ES	STO-MC	2
DART Family...	A-RE-FCR	A, L, or N	LOC, REG, or TH	N/A	ELEM	CH, CONV, NUC, UNC	REQ-P	DYN-ES	DET	2-A-R
MEM (Multiple...)	A-RE	A, SP	GLOB	N/A	JF	STRAT NUC	NR	DYN-ES	STO-MC	2-A-1NR
MIDLAAM	A-RE-CD	A, L, S	GLOB	N/A	COMB	NUC	REQ-SU	STAT	DET-EV	1
NUC-STRATEGYST	A-RE-CD	A, L	GLOB	BAT	CONC	NUC, STRAT	REQ	DYN-TS, STAT	DET	2-A
SAS	A-RE-FCR	A, L, S, SP	GLOB, TH	N/A	COMB, JF	CH, CONV, NUC	REQ	Unknown	Unknown	2-A
SNAP	A-RE-CD	ABS	TH	N/A	N/A	STRAT NUC	REQ-I	STAT	DET	1
STAM	A-OST	A, L	GLOB	A	ELEM	NUC	REQ-SU	DYN-TS	DET	1

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COMB	combined
CONC	conceptual
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S	symmetric

STRATEGIC WARFARE/Damage Assessment

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	T[illegible] Ran[illegible]ness	Number and Type of Sides
DART Family...	A-RE-FCR	A, L, or N	LOC, REG, or TH	N/A	ELEM	CH, CONV, NUC, UNC	REQ-P	DYN-ES	DET	2-A-R
Engage	A-RE-WS	A	IND	TER	ELEM	CONV or NUC	REQ-SU	STAT	DET	1
MEM (Multiple...)	A-RE	A, SP	GLOB	N/A	JF	STRAT NUC	NR	DYN-ES	STO-MC	2-A-1NR
NUC-STRATEGYST	A-RE-CD	A, L	GLOB	BAT	CONC	NUC, STRAT	REQ	DYN-TS, STAT	DET	2-A
SAS	A-RE-FCR	A, L, S, SP	GLOB, TH	N/A	COMB, JF	CH, CONV, NUC	REQ	Unknown	Unknown	2-A
SIDAC	A	A, L	GLOB	MET, W	CONC	STRAT NUC	REQ-SU, I	DYN-TS	DET-EV, STO-MC	N/A
SNAP	A-RE-CD	ABS	TH	N/A	N/A	STRAT NUC	REQ-I	STAT	DET	1

INDEX ABBREVIATION KEY

PURPOSE

Function of Model

A	analysis
A–OST	analysis, operation support tool (decision aid)
A–RE	analysis, research and evaluation tool
A–RE–CD	analysis, research and evaluation tool dealing with combat development
A–RE–FCR	analysis, research and evaluation tool dealing with force capability and requirements
A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
REQ–D	required for decisions
REQ–P	required for processes
REQ–D,P	required for decisions and processes
REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

STRATEGIC WARFARE/Weapons Effectiveness

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
COMET	A-RE-WS	A, SP	GLOB	A, SP	COMP	NUC	REQ-SU	STAT	N/A	1
DIDSIM	A-RE-WS	A, SP	GLOB, IND, LOC, or REG	SP	COMB, JF	NON-NUC, NUC	NR	DYN-ES	DET, STO-MC	2-A-1NR
Engage	A-RE-WS	A	IND	TER	ELEM	CONV or NUC	REQ-SU	STAT	DET	1
MIDLAAM	A-RE-CD	A, L, S	GLOB	N/A	COMB	NUC	REQ-SU	STAT	DET-EV	1
SEAT	A-RE-CD, FCR, WS	A, L	REG	D/N, FOR, TER, W	ELEM	CONV, NUC	REQ-I	DYN-ES, DYN-TS	DET, STO-DC	2-A
SNAP	A-RE-CD	ABS	TH	N/A	N/A	STRAT NUC	REQ-I	STAT	DET	1
STRAT RANGE	A-RE-WS	A	GLOB	A, W	ELEM	STRAT NUC	REQ-D	STAT	N/A	1

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DESCRIPTION

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ABS	abstract
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POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
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SIDEDNESS

Number and Type of Sides

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A	asymmetric
NR	nonreactive
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RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

STRATEGIC WARFARE/Strategic Communications

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
STRATC2AM	A-RE	A, L, N	IND	L	ELEM	CONV	NR	DYN-TS	DET	1
STRAT PATROLLER	A-RE-WS	A	GLOB	A	ELEM	CONV	NR	DYN-ES	DET, STO	2-A

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CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
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REQ	required
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U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

STRATEGIC WARFARE/Tactical Warning

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
TW/AA End-to-End...	A-OST, A-RE-WS, T/E	L, S, SP	GLOB	EAR	COMP	NUC	NP	DYN-ES	STO-DC	2-A-1NR

INDEX ABBREVIATION KEY

PURPOSE

Function of Model

A	analysis
A–OST	analysis, operation support tool (decision aid)
A–RE	analysis, research and evaluation tool
A–RE–CD	analysis, research and evaluation tool dealing with combat development
A–RE–FCR	analysis, research and evaluation tool dealing with force capability and requirements
A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
REQ–D	required for decisions
REQ–P	required for processes
REQ–D.P	required for decisions and processes
REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

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3	three-sided
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NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

STRATEGIC WARFARE/Ballistic Missile Defense

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
FROBAK	A	L, S	GLOB	L, S	N/A	STRAT NUC	REQ-SU	STAT	N/A	1
MEM (Mission...)	A-RE-WS	A, L, SP	GLOB	A, SP	COMB, JF	NON-NUC, NUC	REQ-I	DYN-ES, DYN-TS	DET, STO-MC	1
OPUS1	A-RE-WS	A, SP	GLOB	A	COMP	NUC	REQ-I	DYN-ES	STO-MC	2
SRBS	A-RE	L, SP	TH	SP	JF	STRAT	REQ-D, P	DYN-ES or DYN-TS	STO-MC	1
SWARM	A-RE-WS	A, S	GLOB, INTRA	EAR, SP	COMP	KIN, LAS, NUC	REQ-SU	DYN-ES, DYN-TS	STO-MC	2-S

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DESCRIPTION

Domain

A	air
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ABS	abstract
CO	coast
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POL	politics
S	sea
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Span

GEO	geographic area
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IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
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Environment

A	air
BAR	barrier
BAT	battlefield
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CF	cultural features
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TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
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Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
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DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
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NONSTR	nonstrategic
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Time Processing

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STRATEGIC WARFARE/Strategic Defense

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
FROBAK	A	L, S	GLOB	L, S	N/A	STRAT NUC	REQ-SU	STAT	N/A	1
MEM (Mission...)	A-RE-WS	A, L, SP	GLOB	A, SP	COMB, JF	NON-NUC, NUC	REQ-I	DYN-ES, DYN-TS	DET, STO-MC	1
NADM	A-RE-FCR	A, L, S, SP	GLOB	EAR	Any Mix	STRAT	REQ-A	DYN-ES	STO-MC	2-1NR
SODSIM	A-RE-FCR, A-RE-WS	A, L, SP, US	IND to GLOB	T/D	COMB, JF	STRAT NUC	REQ-I, D	DYN-ES	STO-DC	2-A-R
SRBS	A-RE	L, SP	TH	SP	JF	STRAT	REQ-D, P	DYN-ES or DYN-TS	STO-MC	1
STRAT DEFENDER	A-RE-WS	A, L, SP	GLOB	A, L, SP	COMP	NUC	NR	DYN-ES	DET, STO	2-A
SWARM	A-RE-WS	A, S	GLOB, INTRA	EAR, SP	COMP	KIN, LAS, NUC	REQ-SU	DYN-ES, DYN-TS	STO-MC	2-S
XSTAR	A-RE-WS	A, L, SP	GLOB	EAR	N/A	STRAT NUC	REQ-D	DYN-TS	STO-MC	1-NR

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STRATEGIC WARFARE/Postnuclear Attack

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			[illegible]
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
DART Family...	A-RE-FCR	A, L, or N	LOC, REG, or TH	N/A	ELEM	CH, CONV, NUC, UNC	REQ-P	DYN-ES	DET	2-A-R

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REQ–P	required for processes
REQ–D,P	required for decisions and processes
REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

STRATEGIC WARFARE/Other

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
DETEC	A-RE-WS	L, S, SP	GLOB or TH	SP	COMP	CONV, NUC	NR-INT	DYN-ES	DET, STO-DC	2-A-R

INDEX ABBREVIATION KEY

PURPOSE

Function of Model

A	analysis
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A–RE	analysis, research and evaluation tool
A–RE–CD	analysis, research and evaluation tool dealing with combat development
A–RE–FCR	analysis, research and evaluation tool dealing with force capability and requirements
A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
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A	air
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ABS	abstract
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L	land
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US	undersea

Span

GEO	geographic area
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INTRA	intratheater
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REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
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DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
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GEO	geography
HEX	hex-based
JU	jungles
L	land
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TEMP	temperature
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VEG	vegetation
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Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
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POL	political
RA	rear area
SPEC	special
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UNC	unconventional
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DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
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DET	deterministic
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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Multitheater

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			[illegible]
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ACAAM	A-OST	A, S	LOC to GLOB	CF, TER	ELEM	CONV	REQ-D, P	DYN-ES	STO-MC	2-R
JAWS (J-8 version)	A-RE-FCR	A, L, S	REG to GLOB	A, L, S	COMB, JF	CONV	NR	DYN-ES, DYN-TS	DET-EV	2 or more-S
RSAS	A-OST, TR-ED	A, L, S, SP	GLOB, INTRA, TH	A, L, S	COMB, JF	CONV, NUC, STRAT NUC	NR	DYN-ES, DYN-TS	DET	2-A-R
SAS	A-RE-FCR	A, L, S, SP	GLOB, TH	N/A	COMB, JF	CH, CONV, NUC	REQ	Unknown	Unknown	2-A

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T/E–ED	training and education, exercise driver
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Human Participation

NP	not permitted
NR	not required
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DESCRIPTION

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A	air
AB	airbase
ABS	abstract
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POL	politics
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GEO	geographic area
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A	air
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BAT	battlefield
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TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
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Time Processing

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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Theater

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ACAAM	A-OST	A, S	LOC to GLOB	CF, TER	ELEM	CONV	REQ-D, P	DYN-ES	STO-MC	2-R
Agile	T/E-ED	A, L	TH	D/N, TER, W	COMB	CONV	REQ-D, P	DYN-TS	DET	2-A
ALB-XMOD	A-RE-CD, A-RE-FCR	A, L	TH	BAT, TER, W, TRAF, URB,	COMB, JF	CONV	REQ-D	DYN-ES, DYN-TS	DET-EV	2-S
ASESS	A-OST, T/E-ED	A, L, N	TH	A, W, Night	COMP	CONV	NR	DYN-ES	DET-EV	2-A-R
ATTACK Model	A-RE-WS	A, L	TH	D/N, SEAS, W	ELEM	CONV	REQ-D, P	DYN-ES, DYN-TS	DET	1
AWSIMS	T/E-ED, T/E-SD	A, L, N	TH	CF, D/N, W	COMB, JF	CONV	REQ-D	DYN-TS	STO	3-S-R
BALFRAM	A-RE-CD, FCR, WS	A, L, S	LOC, REG, TH, or GLOB	A, L, S	JF	BIO, CH, CONV, NUC	NP	DYN-TS	DET or STO-MC	2-S
BEST WEAPON	A-RE-WS	A, L	TH	D/N, TD, W	N/A	CONV	REQ-P	DYN-TS	DET-EV	N/A
CEM	A-RE-FCR	A, L	TH	BAR, D/N, TER	COMB	CONV	NP	DYN-TS	DET-EV	2-S
CFAW	A-OST	A, L, N	REG to TH	D/N, HEX, TF, TER, TD, W	COMB, J.	CH. NUC, CONV-RA	REQ-D	DYN-TS	STO-MC	2-S
COMBAT IV	A-RE	A, L, N	REG or TH	TER, TD, W	JF	CH, CONV, NUC	NR-INT	DYN-TS	DET	2-A-R
ConMod	A-RE-CD, FCR, WS, T/E-ED, SD	A, L	LOC, SECT	CF, D/N, DT, MET	COMB, JF	CH, CONV, NUC	REQ	DYN-ES	STO	2-A
Correlation...	A-RE-CD	A, L	LOC, REG, TH	N/A	COMB	CONV, NUC	REQ-SU	STAT	DET	2
FLAPS	A-OST, T/E-ED	A, L	REG, TH	D/N, TER, W	COMP	CONV	REQ-D	DYN-ES, DYN-TS	DET	1
FOF	T/E-ED	L	T.	TF	COMB, JF	CONV-RA	NR-INT	DYN-TS	STO-MC	2-A-R

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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
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INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
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TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
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Treatment of Randomness

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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Theater (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SID
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Numbe Typ Sid
FORCEM	A-RE-FCR	A, L	TH	D/N, TER, TF	COMB, JF	CH, CONV	NR-INT	DYN-TS	DET	2-
GRWSIM	T/E-ED	A, L	TH	D/N, HEX, W, TF/BAR, TER	COMB, JF	CH, CONV, NUC	REQ-D, P	DYN-TS	DET, STO-MC	2-S
IDAHEX	A	A, L	TH	BAR, HEX, TER, TF	COMB	CONV	REQ-D	DYN-ES, DYN-TS	DET	2-
JAWS (J-8 version)	A-RE-FCR	A, L, S	REG to GLOB	A, L, S	COMB, JF	CONV	NR	DYN-ES, DYN-TS	DET-EV	2 or n S
JAWS (NDU version)	T/E-ED	A, L, S	TH	BAR, D/N, W, HEX, TER, TF	COMB, JF	CONV	REQ-D, P	DYN-TS	DET, STO-MC	2-A
JESS	T/E-ED	A, L, N	REG or TH	BAR, HEX, TD, TF, URB, VEG, W	COMB, JF	CH, CONV, NUC	REQ-D, P	DYN-TS	N/A	2-
JTIDSC2	A-OST	A, L, N, SP	TH	COM	COMB, JF	CONV	NP	DYN-ES	STO-DC, STO-MC	N/
JTLS	A-OST, A-RE-FCR, T/E-ED	A, L, N	TH	BAR, HEX, TD, TF, W	COMB, JF	CH, CONV, NUC	REQ-D, P	DYN-ES	DET, STO-DC, MC	2-A
LOGNET	A-RE-FCR	N/A	TH	N/A	COMP	CONV	REQ-D, P	DYN-TS	DET-EV	1
MACRO	A-RE-FCR	A, L	TH	D/N	COMB, JF	CONV	NR	DYN	DET	2-
MACRO-2	A-RE-FCR	A, L	REG	N/A	COMB, JF	CONV	NP	DYN-TS	DET	2-A
Markov...	A-RE-CD	ABS	LOC	BAT	COMP, ELEM	CONV	REQ-D, P	DYN-TS	STO-DC	1
NRMM	A-RE	L	IND to REG	BAR, D/N, DT, TRAF	COMB, JF	CONV, NUC, UNC	REQ-D, P	DYN-ES	DET, STO-MC	2-
N-SNAP	A	L, S	TH	N/A	COMB, JF	NONSTRAT	NP	STAT	DET	1
RSAS	A-OST, TR-ED	A, L, S [illegible]	GLOB, [illegible]RA, TH	A, L, S	COMB, JF	CONV, NUC, STRAT NUC	NR	DYN-ES, DYN-TS	DET	2-A

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A	air
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ABS	abstract
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NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
SAS	A-RE-FCR	A, L, S, SP	GLOB, TH	N/A	COMB, JF	CH, CONV, NUC	REQ	Unknown	Unknown	2-A
SPEED84	A-RE-FCR	A, L	REG	A	COMB, JF	CONV, NUC	NP	DYN-TS	STO-MC	2-A-INR
TACOPS II	T/E	A, L	TH	BAR, D/N, HEX, TER, W	COMB, JF	CH, CONV, NUC	REQ-ID	DYN-ES	DET	2 S
TACWAR	A-OST, A-RE	A, L	TH	A, L, TER	COMB, JF	CH, CONV, NUC	NR	DYN-TS	DET	2-A-R
TACWAR/STC	A-RE-FCR	A, L	TH	BAR, TER	JF	CONV	NR-INT	DYN-TS	DET	2-S
TAM	A-RE-FCR	A, L, S	GLOB, LOC, REG, or TH	TD, TER, SS, W	JF	CONV	REQ-D, P	DYN-ES, DYN-TS	STO-DC	2-S
TAWS	A-RE-CD, T/E-ED	A	TH	D/N, W	ELEM	CONV	NR	DYN-ES	DET, STO-MC	2-S
TRICIA	A-RE-WS	A, L	TH	A, D/N	ELEM	CONV	REQ-D, P	DYN	DET	1
VIC	A-RE-FCR	A, L	TH	A, L	COMB, JF	CONV	REQ-D, P	DYN-ES, DYN-TS	DET	2

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VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Single Service

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
BRLFCS	A-RE	L	INTRA	COM	COMP	CONV	NP	DYN-ES	STO, STO-MC	1
DETCONT	A-RE-CD	L	REG	D/N, TER, W	ELEM	DET	NP	STAT	DET	1
E-EFAM	A-RE-FCR	L	REG	BAR, TER, VEG, W	ELEM	CONV, UNC	REQ-D	STAT	DET	2-S
HELSCAM	A-RE-CD, A-RE-WS	A, L	LOC	DT, MET	N/A	CONV	NP	DYN-ES	STO-MC	2-S
VGCUFS	A-RE-WS	L	LOC	TER	ELEM	CONV	NR	DYN-TS	STO	2-A-INR
VIBAS	A-RE-CD	L	LOC	BAR, TER, TF	ELEM	CONV	NR	DYN-TS	STO-MC	2-A-R

INDEX ABBREVIATION KEY

PURPOSE

Function of Model

A	analysis
A–OST	analysis, operation support tool (decision aid)
A–RE	analysis, research and evaluation tool
A–RE–CD	analysis, research and evaluation tool dealing with combat development
A–RE–FCR	analysis, research and evaluation tool dealing with force capability and requirements
A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
REQ–D	required for decisions
REQ–P	required for processes
REQ–D,P	required for decisions and processes
REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
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STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
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COMP	component
CORPS	corps
ELEM	element
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Scope of Conflict

BIO	biological
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CONV	conventional
DET	detection
ELEC	elec. combat/warfare
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A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Corps or Lower Level

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ALB-XMOD	A-RE-CD, A-RE-FCR	A, L	TH	BAT, TER, W, TRAF, URB	COMB, JF	CONV	REQ-D	DYN-ES, DYN-TS	DET-EV	2-S
Application...	A-RE-WS	ABS	LOC	TER	COMP, ELEM	CONV	REQ-I	STAT	STO-DC	1
BBS (COMBAT-SIM)	TR	A, L	TH	DT, FOR, MET	COMB, JF	CONV	REQ-D, P	DYN-TS	STO	2-A-R
BPS	T/E-SD	A, L	REG	BAR, CF, DT, VEG, W	COMP	CONV	REQ-P	DYN-TS	DET, STO-DC, MC	2-S
Combat Model ELAN+	A-RE-CD	A, L	LOC	TER	COMB	CONV	REQ-D	DYN	DET or STO	2-S
ConMod	A-RE-CD, FCR, WS, T/E-ED, SD	A, L	LOC, SECT	CF, D/N, DT, MET	COMB, JF	CH, CONV, NUC	REQ	DYN-ES	STO	2-A
CORBAN	A-RE-WS	A, L	SECT	FOR, HEX, TF, URB	CORPS	CH, CONV, NUC	REQ	DYN-TS	DET, STO	2-A-R
Correlation...	A-RE-CD	A, L	LOC, REG, TH	N/A	COMB	CONV, NUC	REQ-SU	STAT	DET	2
DETCONT	A-RE-CD	L	REG	D/N, TER, W	ELEM	DET	NP	STAT	DET	1
E-EFAM	A-RE-FCR	L	REG	BAR, TER, VEG, W	ELEM	CONV, UNC	REQ-D	STAT	DET	2-S
HELSCAM	A-RE-CD, A-RE-WS	A, L	LOC	DT, MET	N/A	CONV	NP	DYN-ES	STO-MC	2-S
JANUS/R	A-RE-FCR, A-RE-WS	A, L	LOC	DT, TD, TER, W	ELEM	CONV	REQ-D	DYN-TS	STO-MC	2-S
JAWS (J-8 version)	A-RE-FCR	A, L, S	REG to GLOB	A, L, S	COMB, JF	CONV	NR	DYN-ES, DYN-TS	DET-EV	2 or more-S
MACRO-2	A-RE-FCR	A, [illegible]	REC	N/A	COMB, JF	CONV	NP	DYN-TS	DET	2-A-R
SWATEM	A-RE-CD	A, [illegible]		D/N, TER, W	COMB	CONV	NP	DYN-ES	STO-MC	2-S

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NP	not permitted
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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
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Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
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EAR	earth
EW	electronic warfare
FOR	forestation
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HEX	hex-based
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L	land
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S/S	sunrise and sunset
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TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

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A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air/Ground – Conventional Conflict

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ACAAM	A-OST	A, S	LOC to GLOB	CT, TER	ELEM	CONV	REQ-D, P	DYN-ES	STO-MC	2-R
Agile	T/E-ED	A, L	TH	D/N, TER, W	COMB	CONV	REQ-D, P	DYN-TS	DET	2-A
ALB-XMOD	A-RE-CD, A-RE-FCR	A, L	TH	BAT, TER, W, TRAF, URB	COMB, JF	CONV	REQ-D	DYN-ES, DYN-TS	DET-EV	2-S
ASESS	A-OST, T/E-ED	A, L, N	TH	A, Night, W	COMP	CONV	NR	DYN-ES	DET-EV	2-A-R
ATTACK Model	A-RE-WS	A, L	TH	D/N, SEAS, W	ELEM	CONV	REQ-D, P	DYN-ES, DYN-TS	DET	1
AURA	A-RE-FCR	L	LOC	W	ELEM	CH, COMB, CONV, NUC	NP	DYN-ES, DYN-TS	DET	1
Automated FIRST...	TR-ED	A, L	GEO	TER, VEG	COMB, JF	CONV	REQ-D, P	DYN-TS	STO-MC	2
AWSIMS	T/E-ED, T/E-SD	A, L, N	Th	CF, D/N, W	COMB, JF	CONV	REQ-D	DYN-TS	STO	3-S-R
BBS (COMBAT-SIM)	TR	A, L	TH	DT, FOR, MET	COMB, JF	CONV	REQ-D, P	DYN-TS	STO	2-A-R
BPS	T/E-SD	A, L	REG	BAR, CF, DT, VEG, W	COMP	CONV	REQ-P	DYN-TS	DET, STO-DC, MC	2-S
Combat Model ELAN+	A-RE-CD	A, L	LOC	TER	COMB	CONV	REQ-D	DYN	DET or STO	2-S
COMMANDER V	A-RE-FCR, A-RE-WS	A, L, N	TH	BAR, D/N, TER, W	COMB, JF	CONV	REQ-D	DYN-ES, DYN-TS	A: STO L: DET	2-S
ConMod	A-RE-CD, FCR, WS, T/E-ED, SD	A, L	LOC, SECT	CF, D/N, DT, MET	COMB, JF	CH, CONV, NUC	REQ	DYN-ES	STO	2-A
Correlation...	A-RE-CD	A, L	LOC, REG, TH	N/A	COMB	CONV, NUC	REQ-SU	STAT	DET	2
COSAGE V	A-RE-FCR	A,		D/N, TER, VIS	COMB	CONV	NP	DYN-ES	STO-MC	2-S

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T/E–SD	training and education, skills development
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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
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Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
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S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
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DYN	dynamic
DYN–CF	dynamic, closed form
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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air/Ground – Conventional Conflict (cont'd.)										
NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
DIVLEV	A-RE	L	TH	BAR, D/N, TER, URB, VEG, W	COMB	CH, CONV	NR, REQ-D	DYN-TS	DET	2-A
Fast Stick	T/E-ED	A	LOC	D/N, W	COMP	CONV	REQ-D, P	DYN-ES, DYN-TS	STO-MC	2-A
FLAPS	A-OST, T/E-ED	A, L	REG, TH	D/N, TER, W	COMP	CONV	REQ-D	DYN-ES, DYN-TS	DET	1
FOF	T/E-ED	L	TH	TF	COMB, JF	CONV-RA	NR-INT	DYN-TS	STO-MC	2-A-R
FORGE – FORCEM...	EDU	A, L	TH	D/N, TER, TF	COMB, JF	CONV	NR-INT	DYN-TS	DET	2-S
GRWSIM	T/E-ED	A, L	TH	D/N, HEX, W, TER, TF/BAR	COMB, JF	CH, CONV, NUC	REQ-D, P	DYN-TS	DET, STO-MC	2-S-R
HELSCAM	A-RE-CD, A-RE-WS	A, L	LOC	DT, MET	N/A	CONV	NP	DYN-ES	STO-MC	2-S
JAGUAR	T/E-ED	A	REG	D/N, W	COMP	CONV	REQ-P, A	DYN-TS	DET, STO-MC	2
JAWS (J-8 version)	A-RE-FCR	A, L, S	REG to GLOB	A, L, S	COMB, JF	CONV	NR	DYN-ES, DYN-TS	DET-EV	2 or more-S
JAWS (NDU version)	T/E-ED	A, L, S	TH	BAR, D/N, W, HEX, TER, TF	COMB, JF	CONV	REQ-D, P	DYN-TS	DET, STO-MC	2-A-R
JESS	T/E-ED	A, L, N	REG or TH	BAR, HEX, TD, TF, URB, VEG, W	COMB, JF	CH, CONV, NUC	REQ-D, P	DYN-TS	N/A	2-A
JTLS	A-OST, A-RE-FCR, T/E-ED	A, L, N	TH	BAR, HEX, TD, TF, W	COMB, JF	CH, CONV, NUC	REQ-D, P	DYN-ES	DET, STO-DC, MC	2-A-R
MACRO	A-RE-FCR	A, L	TH	D/N	COMB, JF	CONV	NR	DYN	DET	2-S
MACRO-2	A-RE-FCR	A	REC	N/A	COMB, JF	CONV	NP	DYN-TS	DET	2-A-R
MAWM	A	A		D/N, TER	COMB	BIO, CH, CONV	NR	DYN-ES	DET-EV	2-S

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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air/Ground – Conventional Conflict (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
QJM	A-OST, TR	A, L	SECT	D/N, SEAS, TER, W	COMB, JF	CONV	REQ	DYN-TS	DET	2-S
SOTACA	A-OST	User Specified	GLOB, IND, LOC, REG, or TH	BAT	Any Mix	BIO, CH, NUC, CONV, POL, RA, or SPEC	REQ-D, P	DYN-TS	DET	2-S
Soviet Troop...	T/E-SD	A, L	GEO	A, L	JF	CONV	REQ-D, P	DYN-ES	DET	1
SPEED84	A-RE-FCR	A, L	REG	A	COMB, JF	CONV, NUC	NP	DYN-TS	STO-MC	2-A-1NR
SPIRITS	A	A, L, S, SP, or Combo	TH	EW	COMB or COMP	CONV, NUC	REQ-I, A	STAT	DET	1
SWATEM	A-RE-CD	A, L	IND, LOC	D/N, TER, W	COMB	CONV	NP	DYN-ES	STO-MC	2-S
TACWAR	A-OST, A-RE	A, L	TH	A, L, TER	COMB, JF	CH, CONV, NUC	NR	DYN-TS	DET	2-A-R
TAC WEAPONEER II	A-RE-WS	A, L	LOC	A, EAR	ELEM	CONV	NR	STAT	DET	1
VECTOR-3	A-RE-CD, A-RE-FCR	A, L	TH	BAR, BAT, TF, TRAF, W	COMB, JF	CONV	NR	DYN-ES, DYN-TS	DET-EV	2-S

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REQ-I	required for input
REQ-ID	required for interactive decisions
REQ-SU	required for setup
U-I	user-interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN-CF	dynamic, closed form
DYN-ES	dynamic, event-step
DYN-TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air/Ground – Nuclear and/or Chemical/Biological

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
AIRRAD	A-OST, A-RE	A, L	REG	W	N/A	NUC	REQ-D	DYN-TS	DET	N/A
AURA	A-RE-FCR	L	LOC	W	ELEM	CH, COMB, CONV, NUC	NP	DYN-ES, DYN-TS	DET	1
AWSIMS	T/E-ED, T/E-SD	A, L, N	TH	CF, D/N, W	COMB, JF	CONV	REQ-D	DYN-TS	STO	3-S-R
ConMod	A-RE-CD, FCR, WS, T/E-ED, SD	A, L	LOC, SECT	CF, D/N, DT, MET	COMB, JF	CH, CONV, NUC	REQ	DYN-ES	STO	2-A
Correlation...	A-RE-CD	A, L	LOC, REG, TH	N/A	COMB	CONV, NUC	REQ-SU	STAT	DET	2
D2PC	A	L	LOC	MET	N/A	CH	U-I	STAT	DET	N/A
JANUS 4	A-RE-WS, T/E-ED	A, L	SECT	CF, D/N, DT, MET	COMB, JF	CH, CONV, NUC	NR-INT	DYN-ES	STO-MC	2-A-R
JANUS(T)	A-RE-CD, T/E-ED	A, L, S	REG	CF, D/N, TER, TF, VEG, W	COMB, JF	CH, CONV	REQ-D	DYN-ES	STO	2-A-R
JAWS (J-8 version)	A-RE-FCR	A, L, S	REG to GLOB	A, L, S	COMB, JF	CONV	NR	DYN-ES, DYN-TS	DET-EV	2 or more-S
JESS	T/E-ED	A, L, N	REG or TH	BAR, HEX, TD, TF, URB, VEG, W	COMB, JF	CH, CONV, NUC	REQ-D, P	DYN-TS	N/A	2-A
MAWM	A	A, L	TH	D/N, TER	COMB	BIO, CH, CONV	NR	DYN-ES	DET-EV	2-S
N-SNAP	A	L, S	TH	N/A	COMB, JF	NONSTRAT	NP	STAT	DET	1
NUSSE-3 and NUSSE-3 (ATM)	A-RE-WS	A, L	LOC	A, EAR	N/A	CH	NP	DYN-TS	N/A	N/A
OPSURV	A	L	LOC	BAT	ELEM	CH, CONV, NUC	NR	STAT	DET, STO-MC	2-RED-NR
RWAM	A-RE-WS	L	LOC	N/A	COMP	NUC	NP	STAT	STO-MC	1

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EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
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REQ	required
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AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

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CH	chemical
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ELEC	elec. combat/warfare
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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air/Ground – Nuclear and/or Chemical/Biological (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
SPEED84	A-RE-FCR	A, L	REG	A	COMB, JF	CONV, NUC	NP	DYN-TS	STO-MC	2-A-1NR
3DHZD	A-OST, A-RE	A, L	LOC	W	N/A	CH	REQ-D	DYN-TS	DET	N/A
TACWAR	A-OST, A-RE	A, L	TH	A, L, TER	COMB, JF	CH, CONV, NUC	NR	DYN-TS	DET	2-A-R
VEHW	A	L	LOC	MET, TER	COMP	CH	NP	STAT	DET	N/A
WAM	A-RE-WS	L, S	LOC	L, S	Any Mix	CH, CONV, MIN, NUC	NP	STAT	STO-MC	1

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NP	not permitted
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Domain

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ABS	abstract
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POL	politics
S	sea
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Span

GEO	geographic area
GLOB	global
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INTER	intertheater
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LOC	local
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A	air
BAR	barrier
BAT	battlefield
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COM	communications
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EAR	earth
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FOR	forestation
GEO	geography
HEX	hex-based
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L	land
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TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
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S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Ground Forces Only – Conventional										
	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
NAME OF MODEL	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ARTBASS	T/E-ED	A, L	LOC	BAR, D/N, DT, VEG, W	COMB	CONV	REQ-D, P	DYN-TS	DET, STO	2-S-R
BLDM	A-RE-WS	L	LOC	D/N, DT	COMB	CONV	NR	DYN-TS	DET	2-S
BODESIM	A-OST	L	SECT	BAR, TER, VEG, W	CONC	CONV, UNC	REQ-SU	STAT	DET	2-S
BRLFCS	A-RE	L	INTRA	COM	COMP	CONV	NP	DYN-ES	STO, STO-MC	1
Canadian...	A-RE-CD	A, L	TH	SEAS, TER, W	COMB, JF	CH, CONV, NUC	REQ-D, P	DYN-TS	STO-MC	2-A-R
CASTFOREM	A-RE-WS	A, L	GEO	DT, MET	COMB	CH, CONV, NUC	REQ-SU	DYN-ES, DYN-TS	DET, STO	2-S
DETCONT	A-RE-CD	L	REG	D/N, TER, W	ELEM	DET	NP	STAT	DET	1
Dunn Kempf	T/E-SD	A, L	LOC	TD, TER, W	COMB, JF	CONV	REQ	DYN-ES	STO-MC	2-S
DWG	A-RE-WS	A, L	TH	D/N, MET, TER	COMB	CONV	REQ-D	DYN-ES	DET, STO-DC, MC	2-S
E-EFAM	A-RE-FCR	L	REG	BAR, TER, VEG, W	ELEM	CONV, UNC	REQ-D	STAT	DET	2-S
FIRST FORAY	TR-ED	A, L, S	LOC	D/N, TER, W	COMB, JF	UNC	REQ	DYN	STO-MC	2 or more
MBCS	A-RE-WS	L	LOC	CF, TER	COMB, JF	CONV	NR	DYN-ES	STO-MC	2-A-R
MICA	A-OST, T/E-ED, SD	L	N/A	L	ELEM	CONV	REQ-D	DYN-TS	DET	1
MINDSIM	A-OST, A-RE-WS	L	SECT	BAR, TER, VEG, W	CONC	CONV, UNC	REQ-SU	STAT	DET	2-S
PAWS	A-RE-WS	L	LOC	CAN, FOR, TER	COMB	CONV	NR	DYN-TS	DET	2-A

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PURPOSE

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REQ-SU	required for setup
U-I	user-interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
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TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
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RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
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Time Processing

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Treatment of Randomness

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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Ground Forces Only – Conventional (cont'd.)										
NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
TAFSM	A-RE-WS	L	LOC	L	COMB	CONV	NR	DYN-ES, DYN-TS	STO-MC	2
VGCUFS	A-RE-WS	L	LOC	TER	ELEM	CONV	NR	DYN-TS	STO	2-A-1NR
VIBAS	A-RE-CD	L	LOC	BAR, TER, TF	ELEM	CONV	NR	DYN-TS	STO-MC	2-A-R
WEBS	A-RE-WS	L	LOC	EAR	COMB, JF	CONV	NR	DYN-ES	STO-MC	2-S

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A	air
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AB	airbase
COMB	combined
CONC	conceptual
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CORPS	corps
ELEM	element
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Scope of Conflict

BIO	biological
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NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
AURA	A-RE-FCR	L	LOC	W	ELEM	CH, COMB, CONV, NUC	NP	DYN-TS, DYN-ES	DET	1
BLDM	A-RE-WS	L	LOC	D/N, DT	COMB	CONV	NR	DYN-TS	DET	2-S
CORBAN	A-RE-WS	A, L	SECT	FOR, HEX, TF, URB	CORPS	CH, CONV, NUC	REQ	DYN-TS	DET, STO	2-A-R
JANUS(T)	A-RE-CD, T/E-ED	A, L, S	REG	CF, D/N, TER, TF, VEG, W	COMB, JF	CH, CONV	REQ-D	DYN-ES	STO	2-A-R
NUFAM III	A-RE-FCR	A, L	TH	BAT, URB	ELEM	NUC	REQ-I	DYN-ES	STO-MC	2-A, 2-S
PARACOMPT	A-RE	L	LOC	BAT, MET	ELEM	CH	NP	DYN-TS	STO-MC	1
TARA	A-RE-WS	A, L	REG	DT	ELEM	CH, CONV, DET, NUC, VER	NR	STAT	DET, STO-MC	2-RED-NR
TECH/MAP	A	L	LOC	MET	ELEM	CH	U-I	DYN-ES	STO-MC	1
VEHW	A	L	LOC	MET, TER	COMP	CH	NP	STAT	DET	N/A
YAC	A	L	SECT	BAT, D/N, MET, TER	ELEM	CH	REQ-I	DYN-ES	DET	1

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DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air Forces Only

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ADB (Aircraft...)	A	N/A	N/A	N/A	N/A	N/A	REQ-D	STAT	DET	N/A
ADB (Attrition...)	A-RE-WS	A	TH	D/N, W	N/A	CONV	NP	DYN-ES, DYN-TS	STO-MC	2-A-NR
ADTAM	A-RE-CD	A, L	GLOB	A	ELEM	CONV	REQ-SU	DYN-TS	DET	1
AIRRAD	A-OST, A-RE	A, L	REG	W	N/A	NUC	REQ-D	DYN-TS	DET	N/A
ALEx	A	N/A	N/A	N/A	N/A	CONV	REQ-D	STAT	DET	N/A
ATTACK Model	A-RE-WS	A, L	TH	D/N, SEAS, W	ELEM	CONV	REQ-D, P	DYN-ES, DYN-TS	DET	1
CCBM	A-OST, A-RE	A	LOC	A	ELEM	Any	REQ	DYN-CF, ES, TS	STO-DC, STO-MC	1
Error Analysis...	A-RE-WS	ABS	LOC	N/A	COMP, ELEM	CONV	REQ-I	STAT	STO-DC	1
Fast Stick	T/E-ED	A	LOC	D/N, W	COMP	CONV	REQ-D, P	DYN-ES, DYN-TS	STO-MC	2-A
ITAM	A-RE-CD	A	GLOB	A	ELEM	CONV	REQ-SU	DYN-ES	DET	1
LABS	A-RE-WS	A	LOC	A, EW, MET	ELEM	CONV	REQ-D	DYN-TS	DET-EV or STO-MC	2-A-R
MARGI-TAC	A-OST, A-RE	A, L	INTRA	A	COMB, JF	STRAT NUC	REQ-D, P	DYN-ES	DET-EV, STO-MC	1
SPEED84	A-RE-FCR	A, L	REG	A	COMB, JF	CONV, NUC	NP	DYN-TS	STO-MC	2-A-1NR
TAC SABER	A	A, L, S	TH	BAT, W	N/A	CONV	REQ-I	STAT	DET	1
TAC SELECTOR	A-RE-CD	A, L, S	TH	BAT	N/A	CONV	REQ-I	STAT	DET	1

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T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
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REQ	required
REQ–A	required for analysis
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REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air Forces Only (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
TAC Thunder	A-RE-WS, EDU	A, L	TH	D/N, TER, TRAF, W	COMB, JF	CONV	NR-INT	DYN-ES	DET, STO	2-R
TALCCM	A-OST, A-RE-FCR	A, L	TH	A, MET	ELEM	SPEC	REQ-SU	DYN-ES	STO-MC	1
TEM	A-RE-WS	A, L, S	IND, LOC	TER	ELEM	CONV	NR	DYN-CF	DET	1
TFDTAM	A-RE-FCR	A, L	GLOB	A, MET	ELEM	CONV	REQ-SU	DYN-TS	DET	1
Visual Search	A-OST	A	LOC	A	ELEM	CONV	NR	DYN-TS	DET	1

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U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
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SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Ground and Sea Forces

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
CAMMS	A-OST, T/E-ED	L	IND to REG	BAR, D/N, DT, TRAF	COMB, JF	CONV, NUC, or UNC	REQ-D, P	DYN-ES	DET, STO-MC	2-S
JAWS (J-8 version)	A-RE-FCR	A, L, S	REG to GLOB	A, L, S	COMB, JF	CONV	NR	DYN-ES, DYN-TS	DET-EV	2 or more-S
SPIRITS	A	A, L, S, SP, or Combo	TH	EW	COMB or COMP	CONV, NUC	REQ-I, A	STAT	DET	
Strike	T/E	L	LOC	N/A	AB	CONV	REQ-I	DYN-CF	STO-MC	2-S
STRIKER	A-RE-CD, FCR, WS	A, L, S	REG or TH	L	ELEM	CONV	NR	DYN-TS	STO-MC	2-A; RED-R, BLUE-R, NR
Tomahawk	T/E	L	LOC	N/A	ELEM	CONV	REQ-I	DYN-CF	STO-MC	1

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A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
REQ–D	required for decisions
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REQ–D,P	required for decisions and processes
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REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
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STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
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A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air Combat – One on One

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ARTOAR	A-RE-WS	A	LOC	A	ELEM	CONV	NP	DYN-TS	STO-MC	2-S-NR
BETA	A-RE-WS	A, L, S	IND	N/A	ELEM	CONV	NP	DYN	DET or STO-MC	2-NR

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DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
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DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
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DESCRIPTION

Domain

A	air
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CO	coast
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POL	politics
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SP	space
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Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
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SECT	sector
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Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
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FOR	forestation
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JU	jungles
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AB	airbase
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CONC	conceptual
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CORPS	corps
ELEM	element
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Scope of Conflict

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DET	detection
ELEC	elec. combat/warfare
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NR	nonreactive
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RED-NR	RED side nonreactive (same for BLUE side)
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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air Combat – One on Many

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ADTAM	A-RE-CD	A, L	GLOB	A	ELEM	CONV	REQ-SU	DYN-TS	DET	1

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Span

GEO	geographic area
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LOC	local
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Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
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DT	digitized terrain
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EW	electronic warfare
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AB	airbase
COMB	combined
CONC	conceptual
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CORPS	corps
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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air Combat – Many on Many										
	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
NAME OF MODEL	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
AASPEM	A-RE-WS	A	IND	A	ELEM	CONV	NR	DYN-ES, DYN-TS	STO-DC, STO-MC	2-A-R
ADTAM	A-RE-CD	A, L	GLOB	A	ELEM	CONV	REQ-SU	DYN-TS	DET	1
Balboa	T/E-ED, T/E-SD	A, L	REG	A, L	COMP	CONV, RA	BLUE: REQ-D, P	DYN-TS	STO-MC	2-RED-NR
TAC Brawler	A-OST, A-RE	A	LOC	A, EAR	COMP	CONV	NR	DYN-TS	STO-MC	2-A-R

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Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Reconnaissance

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
Fast Stick	T/E-ED	A	LOC	D/N, W	COMP	CONV	REQ-D, P	DYN-ES, DYN-TS	STO-MC	2-A
RECCE	A-RE-WS	A	GLOB, LOC, or REG	A, CF, DT	COMB	ELEC	REQ-D	STAT	DET	3

INDEX ABBREVIATION KEY

PURPOSE

Function of Model

A	analysis
A–OST	analysis, operation support tool (decision aid)
A–RE	analysis, research and evaluation tool
A–RE–CD	analysis, research and evaluation tool dealing with combat development
A–RE–FCR	analysis, research and evaluation tool dealing with force capability and requirements
A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
REQ–D	required for decisions
REQ–P	required for processes
REQ–D,P	required for decisions and processes
REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
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A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
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CONFLICT OTHER THAN STRATEGIC NUCLEAR/AWACS

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
MULTI-ASPIC	A-RE-CD, A-RE-WS	A	REG	A, TER	ELEM	CONV	REQ-I	DYN-TS	STO-MC	2-A-R

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Function of Model

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EDU	education
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T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
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NP	not permitted
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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	[illegible]
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air Base Attack/Tactical Support

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ABATAK	A-RE-FCR, A-RE-WS	AB	LOC	TD	AB	CH, CONV, NUC	NR-INT	DYN-ES	DET	1
CBAM	A-OST, A-RE	A, AB, L	LOC	A, L	ELEM	CH, CONV	NP	DYN-ES	DET-EV	2-A-1NR
ORDAM	A	L	AB	AB	COMP	CONV	NP	DYN-ES	STO-MC	1
TSAR	A-OST or A-RE-WS	A, L	TH	D/N, GEO, MET, TD	AB	CH, CONV	NP	DYN-ES	STO-MC	2-S
TSARINA	A-OST, A-RE	A, L	LOC	GEO, MET	ELEM	CH, CONV	NP	DYN-ES	STO-MC	2-S

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EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

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NP	not permitted
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U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air Defense

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ACE	A	A	GLOB or TH	A, GEO	COMB, JF	CONV, STRAT NUC	NP	DYN-ES	DET, STO-MC	2-A-R
ASUMS	A-RE-FCR	A	LOC	N/A	ELEM	CONV	REQ-I	DYN-ES	STO-DC	2-S
BEST WEAPON	A-RE-WS	A, L	TH	D/N, TD, W	N/A	CONV	REQ-I	DYN-TS	DET-EV	N/A
BETA	A-RE-WS	A, L, S	IND	N/A	ELEM	CONV	NP	DYN	DET or STO-MC	2-NR
CISCIAD	A-RE-CD	A, L	REG	DT, TD, VEG, W	N/A	CONV	NP	DYN-ES	STO-MC	2-A, RED-NR
COMO III	A-OST, A-RE-WS	A, L	IND to TH	DT, EW, MET	N/A	CONV	REQ-D, P	DYN-ES, DYN-TS	STO-DC, STO-MC	2-A-1NR
CCMO(T)	A-RE-WS	A, L, N	IND to TH	EW, TD, TER, W	COMP	CH, CONV, NUC	NR	DYN-ES, DYN-TS	STO-MC	2-S
End-Game	A-RE-WS	A	IND	A	N/A	CONV	NR	STAT	DET	2
Engage	A-RE-WS	A	IND	TER	ELEM	CONV or NUC	REQ-SU	STAT	DET	1
ESAMS	A-RE-WS	A, L	IND	TER	ELEM	CONV	NP	DYN-TS	DET, STO-MC	1
Fast Stick	T/E-ED	A	LOC	D/N, W	COMP	CONV	REQ-D, P	DYN-ES, DYN-TS	STO-MC	2-A
GUNFIRE	A-RE-WS	A, L	IND, LOC	N/A	ELEM	CONV	NR	DYN-CF	DET	1
HOME	A-RE-WS	A, L	IND	EW	N/A	CONV	REQ-I	DYN	DET	1
IRPD	A-RE-WS	A, L	IND, LOC	A	ELEM	CONV	NR	DYN-CF	DET	1
LOCNES	A-RE-WS	A, L	IND, LOC	A	ELEM	CONV	NR	DYN-CF	DET	1

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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
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VER	verification

Time Processing

DYN	dynamic
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Treatment of Randomness

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SIDEDNESS

Number and Type of Sides

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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air Defense (cont'd.)										
	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
NAME OF MODEL	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
MABS-EX	A-RE-FCR	A	LOC, REG	A, EAR	COMP	CONV	NR	DYN-ES	STO-MC	2-A-1NR
MPRES	A-RE	A	LOC, REG	EAR	ELEM	CONV	NR	DYN-TS	DET	1
NADM	A-RE-FCR	A, L, S, SP	GLOB	EAR	Any Mix	STRAT	REQ-A	DYN-ES	STO-MC	2-1NR
P001	A-RE-WS	A, L	IND	TER	ELEM	CONV	NP	DYN-TS	STO-MC	1
PASTE	A-RE-WS	A, L, S	IND or LOC	CF, SS, TER	N/A	CONV, NUC	NP	DYN-TS	DET-EV, STO-DC, MC	1
PIVADS	A-RE-WS	A, L	IND	A, EAR	ELEM	CONV	NP	DYN-TS	STO-MC	1
RADGUNS	A-RE-WS	A, L, N	IND	L	ELEM	CONV	NR	DYN-TS	DET	1
SAAMBO	A-RE-WS	A	IND, LOC	A	ELEM	CONV	NR	DYN-CF	DET	1
SPAM	A-RE-WS	A	IND	EAR	ELEM	CONV	NP	DYN-TS	DET, STO	2-A-R
SPIRITS	A	A, L, S, SP, or Combo	TH	EW	COMB or COMP	CONV, NUC	REQ-I, A	STAT	DET	1
SUPPRESSOR	A-RE-WS	A, L, N	REG	A, TER	Any Mix	CONV	NR	DYN-ES	DET, STO	User Specified
TACEM	A-RE	A, L	REG	D/N, TER, W	ELEM	CONV	NP	DYN-ES	STO-MC	2-A-R
TAC REPELLER	A-RE-WS	A, L	REG	D/N, TER, W	COMP	CONV	NP	DYN-ES	STO-MC	2-A-R
TACWARS	A, T/E	A	REG	BAT, DT, GEO	ELEM	CONV	NR	DYN	DET, STO-MC	2-S-R
TEM	A-RE-WS	A, L, S		TER	ELEM	CONV	NR	DYN-CF	DET	1

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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
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VEG	vegetation
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AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
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Scope of Conflict

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CONFLICT OTHER THAN STRATEGIC NUCLEAR/Air Defense (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
TOTAL ROUND	A-RE-WS	A, S	REG	A, D/N	N/A	CONV	REQ-SU	DYN-TS	STO-MC	2
TRICIA	A-RE-WS	A, L	TH	A, D/N	ELEM	CONV	REQ-D, P	DYN	DET	1
UVWR	A-RE-WS	A	IND, LOC	W	ELEM	CONV	NR	STAT	DET	1
VEDER	A-RE-WS	A	LOC	A, W	ELEM	N/A	REQ	DYN-TS	DET	1

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AB	airbase
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Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Amphibious Warfare

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
AASPEM	A-RE-WS	A	IND	A	ELEM	CONV	NR	DYN-ES, DYN-TS	STO-DC, STO-MC	2-A-R
AWM	A-RE-FCR, A-RE-WS	A, L, N	REG	SS, TER, TRAF	N/A	CONV	NR	DYN-TS	DET	2-S
TWSEAS-IMC	T/E-ED	A, L, S	IND, LOC, or REG	DT, TD, W, TRAF, VEG	COMP	CONV	REQ-D, P	DYN-TS	STO	2-S-R

INDEX ABBREVIATION KEY

PURPOSE

Function of Model

A	analysis
A–OST	analysis, operation support tool (decision aid)
A–RE	analysis, research and evaluation tool
A–RE–CD	analysis, research and evaluation tool dealing with combat development
A–RE–FCR	analysis, research and evaluation tool dealing with force capability and requirements
A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
REQ–D	required for decisions
REQ–P	required for processes
REQ–D,P	required for decisions and processes
REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
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NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

CONFLICT OTHER THAN STRATEGIC NUCLEAR/Military Operations in Urbanized Terrain (MOUT)										
	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
NAME OF MODEL	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
BLOCKBUSTER	T/E-SD	L	LOC	L	ELEM	CONV	REQ-D, P	DYN-TS	STO	2-A
SEES 1.1	A, TR	L	LOC	CF, D/N, DT, W	ELEM	CH, UNC	NR-INT	DYN-ES	STO-MC	2-A-R
URBAT	T/E-ED	L	LOC	Day, TER, URB	ELEM	CONV	REQ-D	DYN-ES	STO-MC	2-S

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EDU	education
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T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
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REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
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Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
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NR	nonreactive
R	reactive
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S	symmetric

NAVAL MODELS/Conventional Engagements

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
AAR	T/E	L, S	TH	N/A	AB	N/A	REQ-I	DYN-TS	STO-MC	1
ADMRALS	A-RE-CD, FCR, WS	A, S, SP, US	REG	SS, TD, W	COMP	CONC, CONV	NR-INT	DYN-TS	DET, STO-MC	2
ANGEL	A-RE	CO, S	REG	MET, SS	N/A	N/A	REQ-SU	N/A	DET	N/A
CCOMEM	A, T/E	A, L, S	REG	A, L, S	ELEM	CONV	REQ-I	DYN-ES	STO-MC	2-A
COSYCAT	A-RE-WS	S	LOC	S	N/A	CONV	REQ-GR	DYN-ES, DYN-TS	DET-EV	2
CWASAR	A-RE-CD, A-RE-WS	A, S	REG or TH	S	ELEM	CONV	NR	DYN-TS	STO-MC	2-A; RED-R, BLUE-R, NR
IREM	A-RE-FCR, T/E-ED	A, L, S, SP, US	TH	SEAS, W	N/A	CONV, NUC	REQ-D, P	DYN-TS	DET, STO	3-S-R
Kinematics	T/E	L, S	REG	L, S	COMP	N/A	NR	DYN-TS	DET	2-S
LOEM	A-RE-WS	A	GLOB	S	N/A	CONV	REQ-SU	DYN	DET, STO	2
MULTIWAR	A-RE-CD	A, L, S, US	TH	N/A	COMB	CONV, NUC	REQ-D, P	STAT	DET-EV	2-S
MUPPET	A-RE-WS	S	GLOB	S	N/A	CONV	REQ	STAT	DET	1
NAVMOD	A-RE-FCR	A, S	REG or TH	A, S	COMP	CONV	NR	DYN-ES, DYN-TS	DET	2-S-R
PATROL	A-OST, A-RE-FCR	CO, S	IND	SS	ELEM	DET	REQ-I	DYN-CF	DET	1
RESA	A, T/E	A, L, N	TH	MET, W	ELEM, AB	CONV, NUC	REQ-D	DYN-TS	STO-DC, STO-MC	2-S-R
SAB	T/E	S	LOC	N/A	ELEM	CONV	REQ-I	DYN-CF	STO-MC	2-S

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T/E–ED	training and education, exercise driver
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TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
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REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
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SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

NAVAL MODELS/Conventional Engagements (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
SEABAT	A-RE-FCR	A, S	LOC, REG	A, S	COMP	CONV	REQ-I	DYN-ES, STAT	DET-EV	2-S
SHIPDAM	T/E	S	LOC	N/A	ELEM	CONV	REQ-I	DYN-CF	STO-MC	N/A
SPIRITS	A	A, L, S, SP, or Combo	TH	EW	COMB or COMP	CONV, NUC	REQ-I, A	STAT	DET	1
Strike	T/E	L	LOC	N/A	AB	CONV	REQ-I	DYN-CF	STO-MC	2-S
VOLUME	A-RE-WS, EDU	A, S	GLOB	S	N/A	CONV	REQ	STAT	DET	2

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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
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SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
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NR	nonreactive
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S	symmetric

NAVAL MODELS/Force Accounting

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ADMRALS	A-RE-CD, FCR, WS	A, L, N	REG	COM, EW	ELEM	CONV	REQ-A	STAT	DYN-ES, STO-MC	1
MACRO-2	A-RE-FCR	A, L	REG	N/A	COMB, JF	CONV	NP	DYN-TS	DET	2-A-R
NAVMOD	A-RE-FCR	A, S	REG or TH	A, S	COMP	CONV	NR	DYN-ES, DYN-TS	DET	2-S-R

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Domain

A	air
AB	airbase
ABS	abstract
CO	coast
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POL	politics
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Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
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REG	regional
SECT	sector
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Environment

A	air
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TF	transportation factors
TRAF	trafficability
URB	urban
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VEG	vegetation
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Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
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Scope of Conflict

BIO	biological
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NAVAL MODELS/Anti-air Warfare

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
COSYCAT	A-RE-WS	S	LOC	S	N/A	CONV	REQ-GR	DYN-ES, DYN-TS	DET-EV	2
FACTS	A-RE-WS	A, S	IND	MET, S	COMB, JF	CONV	NP	DYN-ES	STO-MC	2-A-INR
IREM	A-RE-FCR, T/E-ED	A, L, S, SP, US	TH	SEAS, W	N/A	CONV, NUC	REQ-D, P	DYN-TS	DET, STO	3-S-R
MUPPET	A-RE-WS	S	GLOB	S	N/A	CONV	REQ	STAT	DET	1
SAB	T/E	S	LOC	N/A	ELEM	CONV	REQ-I	DYN-CF	STO-MC	2-S
SEABAT	A-RE-FCR	A, S	LOC, REG	A, S	COMP	CONV	REQ-I	DYN-ES, STAT	DET-EV	2-S

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AB	airbase
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CONC	conceptual
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Scope of Conflict

BIO	biological
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NUC	nuclear
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RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

NAVAL MODELS/Antisubmarine Warfare

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ASOSM	A-RE-WS	US	LOC	UW	ELEM	CONV, NUC	REQ	DYN-ES	STO	2-S
IREM	A-RE-FCR, T/E-ED	A, L, S, SP, US	TH	SEAS, W	N/A	CONV, NUC	REQ-D, P	DYN-TS	DET, STO	3-S-R
MUPPET	A-RE-WS	S	GLOB	S	N/A	CONV	REQ	STAT	DET	1
SCAT	A-RE-CD, A-RE-WS	A, S, US	GEO	SEA, SS	COMP	CONV, NUC	REQ-SU	DYN-ES	STO-MC	2-S
SIM II	A-RE-WS	A, S, US	LOC	UW	COMP	CONV, NUC	NP	DYN-TS	STO-MC	2-S
Sub-on-Sub	T/E	S	IND	SEAS, SS, TF	ELEM	CONV	REQ-I	STAT	STO-MC	2-S

INDEX ABBREVIATION KEY

PURPOSE

Function of Model

A	analysis
A–OST	analysis, operation support tool (decision aid)
A–RE	analysis, research and evaluation tool
A–RE–CD	analysis, research and evaluation tool dealing with combat development
A–RE–FCR	analysis, research and evaluation tool dealing with force capability and requirements
A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
REQ–D	required for decisions
REQ–P	required for processes
REQ–D,P	required for decisions and processes
REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

NAVAL MODELS/Mines and Barriers

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
NMSTPA	A-OST	S	LOC	S	COMP	CONV	REQ-I	DYN-CF	STO-DC	2-S

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PURPOSE

Function of Model

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A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR -INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
REQ–D	required for decisions
REQ–P	required for processes
REQ–D,P	required for decisions and processes
REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
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NR	nonreactive
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RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

UNCONVENTIONAL WARFARE

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
CRASOF	A-RE-FCR	A, L	GLOB, REG, or TH	D/N, W	ELEM	CONV, UNC	NP	DYN-ES	DET, STO	1
SAR	A-RE-FCR	CO	IND	SS, S/S, TD, W	ELEM	SPEC	REQ-I	DYN-ES	STO-MC	2
SUWAM	T/E-ED	CO, L, S	IND	TER, W	COMB, JF	UNC	REQ-I	DYN-CF	STO-MC	2-A-1R
SUWAM 3.1	T/E-ED	A, L, S	TH	CF, MET, TER, W	COMB, JF	UNC	REQ-D, P	DYN-ES	STO-MC	1-S-R

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EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
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REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

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NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
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CRISIS ACTION SIMULATIONS

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
CFAW	A-OST	A, L, N	REG to TH	D/N, HEX, TER, TF, W	COMB, JF	CH, CONV-RA, NUC	REQ-D	DYN-TS	STO-MC	2-S
SOTACA	A-OST	User Specified	GLOB, IND, LOC, REG, or TH	BAT	Any Mix	BIO, CH, NUC, CONV, POL, RA, or SPEC	REQ-D, P	DYN-TS	DET	2-S

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Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
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TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
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Time Processing

DYN	dynamic
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FORCE ACCOUNTING/FORCE STRUCTURE

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
AFP	A-RE-FCR	A, L	INTRA	N/A	COMP	CONV	NR	DYN-TS	DET, STO-MC	2-S
FASTALS	A-RE-FCR	L	TH	TER	COMP	N/A	NP	DYN-TS	DET	1
FDM	A-RE-FCR	L	GLOB	TER	COMB, JF	CONV	NP	DYN-TS	DET	1
FORCOST	T/E	ABS	N/A	N/A	N/A	N/A	REQ-D	DYN-TS	DET	1
FPM (AFWC version)	T/E-ED	POL	N/A	N/A	CONC	N/A	REQ-D, P	DYN-ES	DET	1
FPM (J-8 version)	A-RE-FCR	A, L, N	GLOB, TH	N/A	COMB, JF	CONV to CH, NONSTRAT, STRAT NUC	REQ-D, P	DYN-ES, DYN-TS	DET	2-S-R
FSTAM	A-RE-FCR	A, L	REG or TH	BAR, D/N, HEX, TER, W, etc.	COMB, JF	CH, CONV, NUC	REQ-D	DYN-ES	STO	2-S
IREM	A-RE-FCR, T/E-ED	A, L, S, SP, US	TH	SEAS, W	N/A	CONV, NUC	REQ-D, P	DYN-TS	DET, STO	3-S-R
LRSAMP	A-OST	N/A	GLOB, REG	N/A	N/A	N/A	REQ-D, P	DYN-ES, DYN-TS	DET	N/A
NUC-STRATEGYST	A-RE-CD	A, L	GLOB	BAT	CONC	NUC, STRAT	REQ	DYN-TS, STAT	DET	2-A
PROLOGUE	A-RE-FCR, A-OST	L	GLOB, IND, REG, or TH	N/A	COMP	CONV	REQ-P	DYN-TS	DET	1
TEMPO	T/E-ED	A	GLOB	A	COMP	CONV, STRAT	REQ-D	DYN-ES, DYN-TS	STO-DC	2-S-R
Total Force...	A-OST	CO, S	N/A	N/A	COMP	N/A	REQ-D, P	STAT	DET, STO-DC	N/A
VIC	A-RE-FCR	A, L	TH	A, L	COMB, JF	CONV	REQ-D, P	DYN-ES, DYN-TS	DET	2

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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
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TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
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SPEC	special
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DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
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STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
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A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE (less strategic systems)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
BONeS	A-RE, TR	A, L	GLOB	A, L, S	N/A	N/A	REQ	DYN-ES	STO-MC	1
CEOPS	A-OST	A, L, N, SP	TH	N/A	COMB, JF	CONV	NP	STAT	STO	N/A
COM/EW	A-RE-WS	A, L, N	REG	COM, EW	ELEM	CONV	REQ-A	STAT	DET-EV. STO-MC	1
COMO ADC3	A-RE-CD	A, L, S	TH	TER, VEG, W	COMB, JF	CONV	NR	DYN-ES	STO-MC	2-S-R
DESCEM	A-OST	A, L, N, SP	TH	COM	COMB, JF	CONV	NP	STAT	DET, STO	N/A
EIEM	A-OST	A, L, N, SP	TH	D/N, DT, MET	COMB, JF	CONV	NP	STAT	DET or STO-MC	N/A
IMPACT	A-RE	ABS	IND	COM	N/A	N/A	REQ-P	DYN	DET	N/A
JCS3	A-RE-WS	A, L, S, US	TH	BAR, DT, TF, URB	JF	CH, CONV, ELEM, NUC	NR	DYN-TS	DET	2-S-R
JTIDSC2	A-OST	A, L, N, SP	TH	COM	COMB, JF	CONV	NP	DYN-ES	STO-DC, STO-MC	N/A
MSEPAM	A-OST	L	INTRA	COM, DT	COMB, JF	CONV	NR	DYN-ES, DYN-TS	DET or STO-MC	N/A
NAM	A-RE-CD, FCR, T/E-SD	A, L	LOC, TH	CF, TER	COMB or JF	ELEC	REQ-I	DYN-ES	DET, STO	1
NETSIM	A	ABS	N/A	COM	N/A	N/A	REQ-I, ID	DYN-TS	STO-DC	1
NETWORK II.5	A	ABS	N/A	COM	N/A	N/A	REQ	N/A	N/A	1
PACES	A-OST	A, L, N, SP	TH	COM	COMB, JF	CONV	NP	STAT	DET, STO-DC, or STO-MC	N/A
PEJ...	A-RE	L	LOC	COM	N/A	N/A	REQ-I	STAT	DET	N/A

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DYN	dynamic
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DESCRIPTION

Domain

A	air
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ABS	abstract
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Span

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INTRA	intratheater
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A	air
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TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
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3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE (less strategic systems) (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
PLRS/EPLRS...	A-RE	A, L	TH	TER	COMB, JF	ELEC	REQ	STAT	DET	1
Radar...	A, TR	A, L, S, SP	N/A	COM	N/A	N/A	REQ-P, I	STAT	STO-DC	1
RCN	A	L	LOC	COM	N/A	N/A	REQ-SU	STAT	DET	1
Space CEM	A-RE-WS	A, L, N, SP	TH	SP	COMP	ELEC	REQ-P	DYN-TS	DET	N/A
TACSIM	T/E-ED	A, L, S	TH	BAT	ELEM	CONV	REQ-D, P	DYN-ES	STO-MC	1
TMDC3ISIM	A-RE	A, L, S	TH	DT	COMB, JF	CONV, NON-NUC	NR-INT	DYN-TS	DET-EV	2-R
WAAM	A-RE	A, L, S, SP	GLOB	N/A	ELEM	NUC	NR	DYN-ES	STO-MC	1

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Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
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SEAS	seasons
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ELECTRONIC WARFARE

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ALARM	A-RE-CD	A, L	IND, LOC	TER	ELEM	CONV	NR	DYN-CF	DET	1
ALARMPP	A-RE	L, S	LOC	A	ELEM	ELEC	NP	DYN	DET	2-S
ALARMSS	A-RE	A, L, S	LOC	A, L, S	ELEM	ELEC	NP	DYN-CF	DET	2-S
COM/EW	A-RE-WS	A, L, N	REG	COM, EW	ELEM	CONV	REQ-A	STAT	DET-EV, STO-MC	1
CRUISE_Missiles	A-RE	N	LOC	SS	N/A	ELEC	REQ-SU	DYN-ES	STO-MC	2-S
DAP	A	ABS	N/A	EW	N/A	ELEC	REQ	STAT	DET	1
DEWCOM	A-RE	A, L, N	IND to TH	COM, EW	ELEM, COMB	CONV	NR-INT	DYN-ES, DYN-TS	A: STO-MC, L: DET	2-A-R
ECECE	A-RE-WS	A, L	IND	EW	N/A	CONV	REQ-P	STAT	DET	2-S
EMSA	A	ABS	N/A	EW	COMB, JF	ELEC	NR	STAT	DET	1
EWS	A	A, L	REG	EW, MET, TER	COMB, JF	ELEC	NR	DYN-ES, DYN-TS	DET, STO	2-S-R
Frequency...	A-OST	A, L, N, SP	TH	COM	COMB, JF	CONV	NP	Statistical	DET, STO-DC or MC	N/A
GEMMTLCM	A-RE-WS	L, S	LOC	A, L	ELEM	ELEC	NP	DYN-CF	DET	2-S
IMOM	A	A, L, N	TH	EW	COMP	ELEC	REQ-P	STAT	DET	N/A
IPARS	A-RE-WS	A	LOC	A	ELEM	ELEC	NP	DYN-CF	DET	2-S
MIDAS	A	L	REG	DT, EW	COMB, JF	ELEC	REQ	STAT	N/A	2

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Scope of Conflict

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Treatment of Randomness

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ELECTRONIC WARFARE (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
NETS	A-RE-WS	A, L	REG	TER	CONC, ELEM	ELEC	NR	DYN-ES, DYN-TS	STO-MC	1
REVAM	A-RE	A, L	LOC	COM, EW	ELEM	CONV	REQ	STAT	DET	1
SCARE	A-RE-WS	A, L	IND or LOC	A, L	ELEM	CONV	NP	DYN-ES	DET or STO-MC	2-A-R
SOJ	A-RE-WS	A, L	IND	MET	N/A	ELEC	REQ-P	STAT	DET	2-S
SPAM	A-RE-WS	A	IND	EAR	ELEM	CONV	NP	DYN-TS	DET, STO	2-A-R
STAIR	A-RE	A, L, S	LOC	A	ELEM	ELEC	NP	DYN	DET	2-S
STEWS	A-RE-WS	A, L, S	LOC, REG	L, S	N/A	ELEC	NR	DYN-TS	DET or STO	2-A-1NR, 2-S
TFMS	A-RE	A, L	REG	CF, TER, W	ELEM	ELEC	REQ-D, P	DYN-ES, DYN-TS	DET	1

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Span

GEO	geographic area
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Environment

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BAT	battlefield
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D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
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GEO	geography
HEX	hex-based
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MET	meteorological conditions
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Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
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RA	rear area
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INTELLIGENCE

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
G2WS	T/E-SD	A, L	TH	COM, D/N, DT, L	COMB, JF	CONV	REQ-P	DYN-ES, DYN-TS	STO-DC	1
ICM	T/E-ED	A	TH	A, L	COMP	CONV, UNC	REQ	DYN-TS	STO-MC	2-A-NR
SPAN	A-OST	L	N/A	COM, EW	COMB, JF	ELEC	NP	STAT	DET	N/A

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WEAPONS SYSTEMS SIMULATIONS/Air Systems Rotary Wing

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
GIFT	A-RE-WS	A, L, S	N/A	N/A	N/A	N/A	REQ-I	N/A	DET, STO	N/A
JANUS/R	A-RE-FCR, A-RE-WS	A, L	LOC	DT, TD, TER, W	ELEM	CONV	REQ-D	DYN-TS	STO-MC	2-S
SPIRITS	A	A. L, S, SP, or Combo	TH	EW	COMB or COMP	CONV, NUC	REQ-I, A	STAT	DET	1
STRAT SURVIVOR	A-RE	A, L	REG	A, L	COMP	STRAT NUC	N/A	STAT	N/A	1
VAST	A-RE-WS	ABS	N/A	N/A	N/A	N/A	NR	N/A	N/A	1

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WEAPONS SYSTEMS SIMULATIONS/Air Systems Fixed Wing

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JANUS/R	A-RE-FCR, A-RE-WS	A, L	LOC	DT, TD, TER, W	ELEM	CONV	REQ-D	DYN-TS	STO-MC	2-S
SPIRITS	A	A, L, S, SP, or Combo	TH	EW	COMB or COMP	CONV, NUC	REQ-I, A	STAT	DET	1
VAST	A-RE-WS	ABS	N/A	N/A	N/A	N/A	NR	N/A	N/A	1

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AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

WEAPONS SYSTEMS SIMULATIONS/Ground Systems

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
GIFT	A-RE-WS	A, L, S	N/A	N/A	N/A	N/A	REQ-I	N/A	DET, STO	N/A
JANUS/R	A-RE-FCR, A-RE-WS	A, L	LOC	DT, TD, TER, W	ELEM	CONV	REQ-D	DYN-TS	STO-MC	2-S
MATADOR	A-RE-WS	L	LOC	N/A	ELEM	CONV	NP	DYN-CF	STO	2-S
SLAVE	A-RE-WS	A, L, S, SP	LOC	A, L, S, SP	ELEM	ELEC	NR	STAT	DET	2-A
SPIRITS	A	A, L, S, SP, or Combo	TH	EW	COMB or COMP	CONV, NUC	REQ-I, A	STAT	DET	1
STOCHADE	A-RE-WS	ABS (L)	LOC or REG	N/A	ELEM	CONV	NR	DYN-ES, DYN-TS	DET, STO	2-S
TANK WARS II	A-RE-WS	L	LOC	BAT	ELEM	CONV	NP	DYN-ES	STO-MC	2-A-R
VAST	A-RE-WS	ABS	N/A	N/A	N/A	N/A	NR	N/A	N/A	1
WEIGHT	A-RE-WS	L, S	N/A	N/A	N/A	N/A	REQ-I	STAT	DET	N/A

INDEX ABBREVIATION KEY

PURPOSE

Function of Model

A	analysis
A–OST	analysis, operation support tool (decision aid)
A–RE	analysis, research and evaluation tool
A–RE–CD	analysis, research and evaluation tool dealing with combat development
A–RE–FCR	analysis, research and evaluation tool dealing with force capability and requirements
A–RE–WS	analysis, research and evaluation tool dealing with weapon systems
EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptible
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
REQ–D	required for decisions
REQ–P	required for processes
REQ–D,P	required for decisions and processes
REQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
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SIDEDNESS

Number and Type of Sides

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NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

WEAPONS SYSTEMS SIMULATIONS/Air Defense											
NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION				SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
CISCIAD	A-RE-CD	A, L	REG	DT, TD, VEG, W	N/A	CONV	NP	DYN-ES	STO-MC	2-A-RED-NR

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REQ–A	required for analysis
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REQ–P	required for processes
REQ–D,P	required for decisions and processes
RFQ–GR	required for graphics
REQ–I	required for input
REQ–ID	required for interactive decisions
REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
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WEAPONS SYSTEMS SIMULATIONS/Special Systems

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
ALWSIM III	A-RE-WS	L	SECT	L	COMP	LAS	NP	DYN-ES, DYN-TS	STO-MC	2
BLUEMAX II	A-RE-WS	A	IND	TER	ELEM	N/A	REQ	DYN-CF	DET	1
CFARC	A-RE-WS	L, S, SP	GLOB	EW	N/A	N/A	NP	DYN-TS	STO-MC	1
DETCONT	A-RE-CD	L	REG	D/N, TER, W	ELEM	DET	NP	STAT	DET	1
Eagle	A-RE-CD, T/E-ED	A, L	TH	TER	COMB, JF	CONV, NUC	REQ-D, P	DYN-TS	DET	2-S-R
EDECSIM	A-RE-WS	A, L	LOC	CF, MET, TER, VEG	CONC	CONV	NR	DYN-ES	STO-MC	2
EOVAC	A-RE	A, L	TH	BAT, D/N	ELEM	CONV	REQ	STAT	STO-DC, STO-MC	2-R
GEMM	A-RE-WS	A, L, S	LOC	A, L	ELEM	CONV	NP	DYN-TS	STO-MC	2-A-R
IEW	A-OST	A, L, N, SP	TH	L, TD, TER	COMB, JF	CONV	NP	DYN-CF, DYN-ES	DET or STO-MC	N/A
OBSERVE	A-RE-CD, T/E-SD	L	REG	D/N, TER, W	ELEM	DET, LAS	NP	DYN-TS	DET	1
TAC RANGER	A-RE-WS	A	IND	N/A	ELEM	CONV	NR	DYN	DET	1
TAPM	A-RE-WS	A, L	REG	TER, W	COMP	CONV	N/A	DYN	DET	N/A
TIS	A-RE-WS	A, L	IND, LOC	W	ELEM	CONV	NR	STAT	DET	1

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REQ–SU	required for setup
U–I	user–interactive

DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
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STAT	static

Treatment of Randomness

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Number and Type of Sides

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A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

WEAPONS SYSTEMS SIMULATIONS/Chemical Systems

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
CHEMCAS III	A-RE-WS	L	TH	N/A	COMP	CH	REQ-SU, P	DYN	STO	1
D2PC	A	L	LOC	MET	N/A	CH	U-I	STAT	DET	N/A
PARACOMPT	A-RE	L	LOC	BAT, MET	ELEM	CH	NP	DYN-TS	STO-MC	1
TECH/MAP	A	L	LOC	MET	ELEM	CH	U-I	DYN-ES	STO-MC	1
VEHW	A	L	LOC	MET, TER	COMP	CH	NP	STAT	DET	N/A
YAC	A	L	SECT	BAT, D/N, MET, TER	ELEM	CH	REQ-I	DYN-ES	DET	1

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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
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SEAS	seasons
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SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
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Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
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ELEC	elec. combat/warfare
KIN	kinetic
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NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

WEAPONS SYSTEMS SIMULATIONS/Weapon Systems, Generic											
NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION				SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness		Number and Type of Sides
GENSAW	A-RE	A, L, S, SP, US	GLOB, IND, LOC, REG, or TH	User Defined	User Defined	User Defined	REQ-I	DYN-CF, DYN-ES	DET or STO		1 or more
ICAN	A-RE	User Specified	User Specified	User Specified	User Specified	User Specified	REQ-D, P	STAT	DET		1
Markov...	A-RE-CD	ABS	LOC	BAT	COMP, ELEM	CONV	REQ-D, P	DYN-TS	STO-DC		1
Micro SAINT	A-RE-WS	ABS	IND, LOC, or REG	User Defined	COMP or ELEM	N/A	NR	DYN-ES	DET or STO-MC		1 or 2
Timeline...	A-RE-WS	ABS	IND	N/A	ELEM	CONV	NP	DYN-ES	STO-MC		1

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DESCRIPTION

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A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
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Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
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LOC	local
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CONC	conceptual
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LOGISTICS

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
AAR	T/E	L, S	TH	N/A	AB	N/A	REQ-I	DYN-TS	STO-MC	1
ADS	A-OST	N/A	N/A	N/A	N/A	N/A	NR	DYN-CF	DET	1
AESOPS	A-OST	A	IND	Unknown	ELEM	CONV	NR-INT	DYN-TS	DET-EV	2-A
APS	A	ABS	LOC	D/N	CORPS	Any	NP	DYN-TS	DET, STO-DC, MC	1
ASOAR	A-RE-WS	ABS	N/A	N/A	N/A	N/A	REQ-SU	STAT	DET	1
Buildup	A-RE	L	INTRA	TRAF	ELEM	CONV	REQ-SU, A	DYN-TS	DET	N/A
CAMP	A-RE-FCR	A, S	GLOB	N/A	COMP	N/A	NR	DYN-ES, DYN-TS	DET	1
CAM-X	A-OST	A, L	GEO	TF	Variable	Variable	NR	DYN-ES	DET or STO-MC	1
CASMO	A-RE-WS	L	LOC	N/A	ELEM	CONV	NP	DYN-ES	DET-EV, STO	1
DEPLOY	T/E	A, S	TH	N/A	N/A	N/A	REQ-D	DYN-TS	DET	1
JAWS (J-8 version)	A-RE-FCR	A, L, S	GLOB to REG	A, L, S	COMB, JF	CONV	NR	DYN-ES, DYN-TS	DET-EV	2 or more-S
LDM	A-RE-FCR	L	TH	N/A	COMB	CONV	NR	DYN-TS	DET	2-S
LFMD/AMIP	A-RE-CD	A, L	TH	CF, D/N, TER, W	COMB, JF	CH, CONV, RA	NR	DYN-ES, DYN-TS	DET	2-A-R
LOGATAK III	A-RE-FCR, A-RE-WS	AB	LOC	TD	AB	CH, CONV, NUC	NR-INT	DYN-ES	DET	1
LOGNET	A-RE-FCR	N/A	TH	N/A	COMP	CONV	REQ-D, P	DYN-TS	DET-EV	1

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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
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A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

LOGISTICS (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
MACATAK	A-OST	L	GEO	N/A	ELEM	CH, CONV, NUC	NR	DYN-ES	STO-MC	1
MAWLOGS	A-OST	A, L	GEO	Variable	CONC	CH, CONV, NUC	NR	DYN-ES	DET or STO-MC	1
Micro-FASTALS	A-RE-FCR	L	TH	TER	COMP	N/A	NP	DYN-TS	DET	1
MRM	T/E	L	TH	N/A	COMP, JF	N/A	REQ-I	DYN-TS	STO-MC	1
OSAMM	A-RE-WS	L	GLOB	N/A	N/A	N/A	NR	STAT	DET-EV	1
POL	T/E	S	INTRA	N/A	COMP	N/A	REQ-I	DYN-TS	DET	1
RETCOM	A-RE-WS	L	GEO	N/A	COMP	CONV	NP	DYN-ES	STO	1
TRANSACT	A-OST	A, L	GEO	TF	Variable	Variable	NP	DYN-ES	DET or STO-MC	1
TSAR	A-OST or A-RE-WS	A, L	TH	D/N, GEO, MET, TD	AB	CH, CONV	NP	DYN-ES, DYN-TS	STO-MC	2-A-1NR
TSARINA	A-OST, A-RE	A, L	LOC	GEO, MET	ELEM	CH, CONV	NP	DYN-ES	STO-MC	2-S
TTSM	T/E-ED	L	TH	BAR, CF, L	COMB, JF	RA	REQ-D, P	DYN-TS	DET	1NR

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EDU	education
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T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
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CONSTRUCTION

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NP	not permitted
NR	not required
NR–INT	not required, model interruptable
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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
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S	sea
SP	space
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Span

GEO	geographic area
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FOR	forestation
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CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
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MOBILIZATION AND INDUSTRIAL PREPAREDNESS

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
FORGE (The Force...)	A-RE	L	GLOB, TH	TF	COMP	CONV	REQ-D	DYN-TS, STAT	DET	1
MME	T/E	N/A	INTER	N/A	COMP	N/A	REQ-A, D	DYN-TS	DET	1

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TRANSPORTATION AND MOBILITY

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
AMM	A-RE	L	IND to REG	BAR, D/N, DT, TRAF	COMB, JF	CONV, NUC, or UNC	REQ-D, P	DYN-ES	DET, STO-MC	2-S
CAMP	A-RE-FCR	A, S	GLOB	N/A	COMP	N/A	NR	DYN-ES, DYN-TS	DET	1
DEPLOY	T/E	A, S	TH	N/A	N/A	N/A	REQ-D	DYN-TS	DET	1
JAWS (NDU version)	T/E-ED	A, L, S	TH	BAR, D/N, W HEX, TER, TF	COMB, JF	CONV	REQ-D, P	DYN-TS	DET, STO-MC	2-A-R
JPLAN and RADEX	T/E-ED	J: A R: A, S	TH	TF	JF	CONV	REQ-D, P	STAT	DET	1
MASS	A-RE-FCR	A, AB	GLOB	A, MET	COMP	CONV	NP	DYN-ES	DET, STO	1
MINOTAUR	A-RE-FCR	A, S, L	GLOB, INTER	A, S	JF	CONV	REQ-D, P	DYN-ES, DYN-TS	DET	1
NRMM	A-RE	L	IND to REG	BAR, D/N, DT, TRAF	COMB, JF	CONV, NUC, or UNC	REQ-D, P	DYN-ES	DET, STO-MC	2-S
RAPIDSIM	A-RE-FCR	A, L, S	INTER	N/A	COMB, JF	CONV	NP	DYN-ES, DYN-TS	DET	1
SITAP	A	A, L, S	INTER	N/A	COMB, JF	CONV	NP	DYN-ES, DYN-TS	DET	1
STAT	A-RE	A, L, S	GLOB to LOC	TD, TRAF	JF	RA	NR-INT	DYN-ES	DET	1
TACAP	A-OST	A	GLOB	GEO, W	ELEM	CONV	REQ-I	DYN	DET	1
TAC Thunder (ILM)	A	A, L, N	GLOB	A	COMB, JF	CONV	NR	DYN-ES	STO	2-A
TRANATAK	A-OST	A, L	GEO	TF	Variable	Variable	NR	DYN-ES	DET, STO-MC	1
TRANSACT	A-OST	A, L	GEO	TF	Variable	Variable	NR	DYN-ES	DET or STO-MC	1

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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
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Environment

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CF	cultural features
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VEG	vegetation
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Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

Scope of Conflict

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CH	chemical
CONV	conventional
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NONSTR	nonstrategic
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RA	rear area
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TRANSPORTATION AND MOBILITY (cont'd.)

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
TRANSMO	A	A, S	INTER	TF, TRAF	CONC	CH, CONV	NR	DYN-ES, DYN-TS	DET-EV	1
TTSM	T/E-ED	L	TH	BAR, CF, L	COMB, JF	RA	REQ-D, P	DYN-TS	DET	1NR

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AB	airbase
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MEDICAL

	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
NAME OF MODEL	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
MRM	T/E	L	TH	N/A	COMP, JF	N/A	REQ-I	DYN-TS	STO-MC	1
Micro-PFM	A-RE-FCR	L	GEO	TH	N/A	N/A	NP	DYN	DET	1

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ECONOMIC										
	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
NAME OF MODEL	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
Bottom Line	T/E-ED	POL	N/A	N/A	N/A	N/A	REQ	STAT	DET	1

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Scope of Conflict

BIO	biological
CH	chemical
CONV	conventional
DET	detection
ELEC	elec. combat/warfare
KIN	kinetic
LAS	laser
MIN	mines
NONSTR.	nonstrategic
NUC	nuclear
POL	political
RA	rear area
SPEC	special
STRAT	strategic
UNC	unconventional
VER	verification

Time Processing

DYN	dynamic
DYN–CF	dynamic, closed form
DYN–ES	dynamic, event-step
DYN–TS	dynamic, time-step
STAT	static

Treatment of Randomness

DET	deterministic
DET-EV	deterministic, generates value as a function of an expected value
STO	stochastic
STO-DC	stochastic, direct computation
STO-MC	stochastic, Monte Carlo

SIDEDNESS

Number and Type of Sides

1	one-sided
1NR	one side nonreactive (same for reactive)
2	two-sided
3	three-sided
A	asymmetric
NR	nonreactive
R	reactive
RED-NR	RED side nonreactive (same for BLUE side)
S	symmetric

ENVIRONMENTAL EFFECT										
NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
LOWTRAN 7	A-RE	A	GLOB	A	N/A	N/A	REQ-I	STAT	DET	1

INDEX ABBREVIATION KEY

PURPOSE

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EDU	education
T/E	training and education
T/E–ED	training and education, exercise driver
T/E–SD	training and education, skills development
TR	training

CONSTRUCTION

Human Participation

NP	not permitted
NR	not required
NR–INT	not required, model interruptable
NR–SC	not required, model has scheduled changes
REQ	required
REQ–A	required for analysis
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DESCRIPTION

Domain

A	air
AB	airbase
ABS	abstract
CO	coast
L	land
N	naval
POL	politics
S	sea
SP	space
US	undersea

Span

GEO	geographic area
GLOB	global
IND	individual
INTER	intertheater
INTRA	intratheater
LOC	local
REG	regional
SECT	sector
TH	theater

Environment

A	air
BAR	barrier
BAT	battlefield
CAN	canalization
CF	cultural features
COM	communications
DES	deserts
D/N	day and night
DT	digitized terrain
EAR	earth
EW	electronic warfare
FOR	forestation
GEO	geography
HEX	hex-based
JU	jungles
L	land
MET	meteorological conditions
S	sea
SEAS	seasons
SP	space
SS	sea states
S/S	sunrise and sunset
TD	time of day
TEMP	temperature
TER	terrain
TF	transportation factors
TRAF	trafficability
URB	urban
UW	underwater
VEG	vegetation
W	weather

Force Composition

AB	airbase
COMB	combined
CONC	conceptual
COMP	component
CORPS	corps
ELEM	element
JF	joint

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MISCELLANEOUS

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
Kinematics	T/E	L, S	REG	L, S	COMP	N/A	NR	DYN-TS	DET	2-S
NEST	A-OST, T/E-3D	L, SP	GLOB to LOC	EAR, SP	COMB, JF	N/A	REQ-D, P	DYN-TS	DET	1
OSADS	A-RE	A, L, S	IND	A	ELEM	CONV	NP	STAT	DET	1
TAGS	A-OST	N/A	N/A	N/A	N/A	CONV	NR	DYN-TS	DET	1

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GEO	geography
HEX	hex-based
JU	jungles
L	land
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SEAS	seasons
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SPACE										
	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
NAME OF MODEL	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
SFEM	A-RE-WS, TR	A, L, S, SP	GLOB	D/N, EAR, EW, MET	N/A	CONV or NUC	REQ-SU	DYN-ES	DET or STO-MC	1 (will be 2)

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ABS	abstract
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Span

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COM	communications
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FOR	forestation
GEO	geography
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WEATHER

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
AURA	A-RE-FCR	L	LOC	W	ELEM	CH, COMB, CONV, NUC	NP	DYN-ES, DYN-TS	DET	1
CLDGEN	A-RE	A	GLOB	A	N/A	N/A	REQ-I	STAT	STO	1
CVOF	A	A, SP	GLOB	MET, W	N/A	N/A	NP	DYN-TS	STO-MC	1
DNYPSIM	A-RE	A	GLOB	D/N, MET, W	N/A	N/A	NR	DYN-TS	STO-MC	1

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Force Composition

AB	airbase
COMB	combined
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ELEM	element
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Scope of Conflict

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LOW INTENSITY CONFLICT

NAME OF MODEL	PURPOSE	DESCRIPTION					CONSTRUCTION			SIDES
	Function of Model	Domain	Span	Environment	Force Composition	Scope of Conflict	Human Participation	Time Processing	Treatment of Randomness	Number and Type of Sides
Low Intensity...	A-OST, T/E	POL	REG	N/A	CONC	CONC, UNC	REQ-D, P	DYN-ES, DYN-TS	STO-DC	3 or more-R or NR
PANTHER: Low...	T/E-ED	A, L, S	LOC or REG	D/N, L, TER, W	COMP	CONV	REQ-D, P	DYN-TS	STO-MC	3; RED, BLUE-S or A, GRAY-A-NR
SLIC	A	ABS	LOC	N/A	ELEM	POL, UNC	NR	DYN	DET, STO	2

TITLE: AAR - Air Availability and Repair

MODEL TYPE: Training and education (support of seminar war games).

PROPONENT: Wargaming Department, Naval War College.

POINT OF CONTACT: Micromodels Manager, (401) 841-3276, AV 948-3276.

PURPOSE: AAR models air combat sustainability and aircraft battle damage repair rates. It is designed to provide logistical input to larger-scale war games.

DESCRIPTION:

Domain: Land and sea.

Span: Theater.

Environment: N/A.

Force Composition: Theater-level aircraft groups and wings.

Scope of Conflict: N/A.

Mission Area: Logistics.

Level of Detail of Processes and Entities: Users define aircraft type and quantities, as well as mission, airfield (including attack aircraft carriers), and depot capabilities. Users supply attrition, damage, and repair rates.

CONSTRUCTION:

Human Participation: Required for initial inputs only.

Time Processing: Dynamic, time-step model.

Treatment of Randomness: Stochastic, with Monte Carlo determination of result.

Sidedness: One-sided.

LIMITATIONS: AAR assumes repaired aircraft are fully mission capable and does not identify the type or extent of damage. User input intensive.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None anticipated.

INPUT: Aircraft quantity, type, location, and mission; attrition, damage, and repair rates as function of mission and aircraft type; spares kit availability; airfield or depot location; repair priorities and capabilities; day/times of missions; and aircraft/kit movements.

OUTPUT: Detailed mission summary reports by target, airfield, and aircraft type. Reports are by days and may be specified for first and last days of campaign or for each day.

HARDWARE AND SOFTWARE:

Computer: Dual drive IBM-compatible PC with 512K RAM.
Storage: N/A.
Peripherals: N/A.
Language: FORTRAN.
Documentation: User's manual, source code.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: September 1988.

Data Base: One hour.

CPU time per Cycle: N/A.

Data Output Analysis: Detailed mission summary reports by target, aircraft, and airfield.

Frequency of Use: Several times per year anticipated.

Users: Wargaming Department, Naval War College.

Comments: AAR is based on algorithms presented by Major J. F. Torsak, USMC, in "Aircraft Battle Damage Repair, Global Wargame 86 - Exploring the Strategic Alternatives," NWC 09-87. It is used to provide aircraft logistics input to larger-scale war games.

TITLE: AASPEM - Air-to-Air System Performance Evaluation Model Support

MODEL TYPE: Analysis.

PROPONENT: Engineering/Analysis Support, AD/XRY, Eglin AFB, FL 32542.

POINT OF CONTACT: Mr. Carson W. Sasser, (904) 882-3722, AV 872-3722.

PURPOSE: AASPEM is used primarily to analyze future weapon concepts. It simulates few-on-few air engagements between two opposing forces.

DESCRIPTION:
Domain: Air.

Span: Mission.

Environment: Air engagement only, terrain and weather are not modeled.

Force Composition: Opposing flights of aircraft.

Scope of Conflict: Conventional weapons.

Mission Area: Counterair.

Level of Detail of Processes and Entities: The following subsystems are modeled: aerodynamic characteristics, propulsion systems, signature, and avionics of each type of aircraft; the seekers, guidance, aeropropulsion, and endgame lethality for each type of missile; and the fire control system and lethality for each type of gun. Three levels of detail can be modeled for each aircraft sensor.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Dynamic, time-step and event-step model.

Treatment of Randomness: Air attrition stochastically based on direct computation of probability of detection and probability of kill with Monte Carlo determination of result.

Sidedness: AASPEM is a two-sided asymmetric model in which both sides are reactive.

LIMITATIONS: Requires a computer with virtual memory. Can run up to 24 aircraft and 75 vehicles.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None at present.

INPUT: Control and scenario parameter inputs, aircraft performance data, aircraft sensor data, radar and ECM data, jammer data, aircraft thrust data, aircraft fuel flow data, aircraft aero data, missile performance data, missile guidance data, missile aero data, firing screen data, detection contours, missile pK data, WVR tactics data, pilot decision logic, EW threat data, and initial conditions.

OUTPUT: Reflected inputs, narrative of events, missile trajectory, aircraft desired parameters, internal program error report, specific excess power curves, pilot decisions RED and BLUE, engagement summary, and mission profile calculation.

HARDWARE AND SOFTWARE:

Computer:	Currently being run on APOLLO, VAX, and MicroVAX II computers, which have virtual memory. AASPEM requires a large amount of memory.
Storage:	9,975 blocks needed before data base installed.
Peripherals:	Printer, graphics terminal, and graphics hard copy unit.
Language:	FORTRAN 77.
Documentation:	AASPEM User Manual and AASPEM Analyst Manual, 11 Nov 1985.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1985.

Data Base: Highly dependent on how much problem varies from previous study. Building entirely new missile, aircraft, and sensor files could take several man-years.

CPU Time per Cycle: Average run time varies with scenario size and computer equipment; a typical engagement of 12 aircraft runs on a MicroVAX II in about 30 minutes of CPU time.

Data Output Analysis: AASPEM has an interactive graphic display of air-to-air battle. Many output files can be specified and programs are available to summarize and analyze data.

Frequency of Use: Daily.

Users: Engineering/Analysis Support AD/XRY, Foreign Technology Division FTD/TQIO, HQ Strategic Air Command SIW/DIA, Aeronautical System Division ASD/XRM, and several government contractors.

Comments: Owned by the U.S. Government.

TITLE: ABATAK - Air Base Attack Model

MODEL TYPE: Analysis.

PROPONENT: The BDM Corporation, 7915 Jones Branch Drive, McLean, VA 22102.

POINT OF CONTACT: Edmund J. Bitinas, (703) 848-5246.

PURPOSE: ABATAK is a research and evaluation tool used to determine weapon system effectiveness, force capability, and requirements for air base attack effectiveness and sortie generation resource planning.

DESCRIPTION:

Domain: Single airbase.

Span: Multi-day sortie generation for single airbase.

Environment: Explicit time of day, geographic distribution of airbase facilities and interconnecting runways, taxiways, and roads.

Force Composition: Single airbase, with all forces and supporting infrastructure.

Scope of Conflict: Conventional, chemical, and nuclear weapons effects.

Mission Area: Aircraft sortie generation and offensive counter air.

Level of Detail of Processes and Entities: Explicit aircraft, logistics (by each or ton), ground crew personnel and airbase facilities (hangars, shelters, etc.).

CONSTRUCTION:

Human Participation: Not required. Model interruptable with scheduled changes.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Deterministic with random values generated from input functions.

Sidedness: One-sided.

LIMITATIONS: Damage repair times are input and do not consume resources.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Airbase geometry and facility layout; number of assets available; number of aircraft; sortie generation profile over time; attacks, including aim points and effectiveness; off-base attrition; and break rates of aircraft.

OUTPUT: Printed listing of sortie generation over time, resource utilization, and attack effects; graphics postprocessor for trends over time.

HARDWARE AND SOFTWARE:

Computer: VAX/VMS family.
Storage: 1 MB.
Peripherals: Printer and hard copy graphics.
Language: FORTRAN with DISSPLA graphics.
Documentation: User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: August 1983.

Data Base: One to three months.

CPU time per Cycle: Seven days of sortie generation in 15 minutes.

Data Output Analysis: Postprocessor provides graphics as well as raw data output.

Frequency of Use: One to three studies per year.

Users: The BDM Corporation.

Comments: None.

TITLE: ACAAM - Air Courses of Action Assessment Model

MODEL TYPE: Analysis.

PROPONENT: Force Structure, Resource and Assessment Directorate (J-8/TSD), The Joint Staff, The Pentagon, Room 1D929, Washington, DC 20318-8000

POINT OF CONTACT: LTC K. C. Yealy, (202) 693-4603, AV 223-4603

PURPOSE: ACAAM is an operations and planning support tool (decision aid) that is used to assess integrated strike plans for aircraft and cruise missile delivery of conventional weapons.

DESCRIPTION:

Domain: Air and sea.

Span: Local to global.

Environment: Terrain relief includes cultural features (employs digital terrain and elevation data).

Force Composition: Aircraft, cruise missiles, surface-to-air missiles, and guns (WAS only).

Scope of Conflict: Conventional, power projection (land and sea).

Mission Area: Integrated cruise missile and aircraft strike planning.

Level of Detail of Processes and Entities: Processes: Target evaluation, weaponeering, allocation, route development, strike force coordination, and strike prestrike assessment. Entities: Aircraft, cruise missiles, surface-to-air missiles, and guns (WAS only).

CONSTRUCTION:

Human Participation: Required for processes and decisions.

Time Processing: Dynamic, event-step model.

Treatment of Randomness: Prestrike assessment is stochastic, Monte Carlo.

Sidedness: Two-sided, reactive only via system iterations.

LIMITATIONS: Airborne intercepts are not factored into assessment algorithm. No on-board/standoff jamming (land attack only). Prototype executes on GENISCO graphics terminal. Limited aircraft representation (i.e., full representation of A-6, F-111, KA-6D, and KC-135; partial representation of A-7, B-52, F-16, and F-15).

PLANNED IMPROVEMENTS AND MODIFICATIONS: Model will be ported to the SUN computer for operational deployment. Five additional aircraft will be added in FY89. Airborne intercepts and standoff jamming will be incorporated into the model.

INPUT: Targets, defenses, resources, assets, and digital terrain elevation data performance characteristics.

OUTPUT: Computer printouts, plots, raw data, terminal graphics, and hard copy of graphics screens. Prioritized target list; single-shot probabilities of damage; weapon system to target allocations; strike routes including time distance, fuel, and probability of survival values; potential in-flight and fratricide conflicts; damage expectancy to the target base; and own force vulnerability estimates reports.

HARDWARE AND SOFTWARE:

Computer:	MicroVAX (VMS 4.5), GENISCO graphics terminal, Tektronix terminal, printer, digitizer, and graphics screen printer.
Storage:	N/A.
Peripherals:	N/A.
Language:	Ada, FORTRAN.
Documentation:	ACAAM User's Manual.

SECURITY CLASSIFICATION: Model without data is unclassified. Weaponeering algorithm will be Secret.

GENERAL DATA:

Date Implemented: 1988.

Data Base: 8 hours.

CPU time per Cycle: 5 minutes.

Data Output Analysis: Immediate to 2 hours.

Frequency of Use: Depends on requirements.

Users: Joint Staff, J-8, and CAD.

Comments: Prototype installed at USCINCPAC in October 1988.

TITLE: ACE - Advanced Campaign Effectiveness Model, Version II, and the Sortie Evaluation (SORVAL) Post-processor

MODEL TYPE: Analysis.

PROPONENT: Rockwell International, North American Aviation, Operations Analysis Department, 011-116/061--GB02, El Segundo, CA 90045.

POINT OF CONTACT: Michael S. Anderson, (213) 414-2294.

PURPOSE: ACE is used to establish the effectiveness of a strategic sortie penetration of an enemy air defense system.

DESCRIPTION: ACE simulates an offensive force of bombers, cruise missiles, and support aircraft penetrating a defensive structure of ground and air threats. Important output MOEs are bombers probability of survival and number of WOT. Bomber PS may be calculated on either a Monte-Carlo or expected value basis. WOT is measurable for both fixed, planned targets and for SRT missions.

Domain: Air, SIOP operations.

Span: Global or theater.

Environment: Geographically based (latitude/longitude input). Extensive use of PK tables.

Force Composition: Combined and joint forces

Scope of Conflict: Strategic nuclear and conventional forces.

Mission Area: SIOP.

Level of Detail of Processes and Entities: Entities: aircraft (bomber, short-range missile, gravity weapon, cruise missile, fighter, and AWACS by tail number); EW/GCI (by site, i.e., collocated collection of radars); SAM (by site, i.e., to battery level); airbase (by site, i.e., collection of airstrips and recycle facilities); net (defined by AWACS, EW/GCI, and fighter assigned to it); and targets (fixed targets by position and SRT targets by area of uncertainty and search evaluation position).

Processes: Bomber, cruise missile (flight, weapon release, SRT search, and weapon launch); SAM (autonomous target detection, tracking, and engagement); AWACS, EW/GCI (AWACS orbiting, target detection, tracking, and net-wide warning); net (fighter commitment, vectoring, and recovery); Airbase (fighter basing, refueling, and rearming); and fighter (remote air patrol, target detection, flyout, arrival, and engagement).

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step simulation.

Treatment of Randomness: Monte Carlo treatment of SRT search and fighter vectoring. Either Monte Carlo or deterministic treatment of bomber PS and fixed-target WOT.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: The numbers of entities playable in the model is controlled by FORTRAN parameter statements. The source code is simply recompiled to play more penetrators or threats. Terrain is played statistically and is represented by roughness codes at each EW/GCI and SAM site to modify the line-of-sight detection radius. Site-specific terrain is not played. The "mid latitude" method of representing geographical movement of bombers and fighters restricts play to the northern hemisphere.

PLANNED IMPROVEMENTS AND MODIFICATIONS: More detailed representations of the SAM fire and intercept game and the fighter vectoring and combat endgames. Port to UNIX environment. Graphical user interface for a simulation progress display and input data verification. Addition of DMA terrain effects on target tracking.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer:	IBM 4341 (VM/CMS), IBM 3084 (MVS/TSO), VAX 11/780 (VMS), Sun Series 4 (UNIX).
Storage:	Four MB RAM.
Peripherals:	Printer.
Language:	ANSI FORTRAN 77 and isolated system-specific code for date and time calculations.
Documentation:	Rockwell/NAA TFD-87-1100, "ACE-11 Operations Guide", 1 March 1987; Rockwell/NAA TFD-87-1610, "SORVAL Operations Guide", 1 December 1987.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: March 1987 (ACE-11), December 1987 (SORVAL)

Data Base: 4 to 10 weeks.

CPU time per Cycle: 30 to 60 minutes per replication.

Data Output Analysis: Variable.

Frequency of Use: Better than monthly.

Users: Rockwell/NAA; ASD/ENSS.

Comments: ACE is maintained and its configuration is controlled by Rockwell/NAA for use at Rockwell and ASD/ENSS.

TITLE: ADB - Aircraft Data Base

MODEL TYPE: Analysis.

PROPONENT: Operations Analysis (OA) Unit, Boeing Military Airplanes (BMA), P.O. Box 7730, M/S K80-33, Wichita, KS 67277-7730.

POINT OF CONTACT: John E. Huffman, (316) 685-9669.

PURPOSE: ADB is used as a data manager for many of the mission simulation models used at Boeing OA. In particular, ADB supplies data organized in the Relation Information Management data base to Tanker/Airlift models. Data is taken from eight different data base relations.

DESCRIPTION:

Domain: Model specific.

Span: Model specific.

Environment: Model specific.

Force Composition: Model specific.

Scope of Conflict: Model specific.

Mission Area: Model specific.

Level of Detail of Processes and Entities: Entity: Aircraft. Processes: Model specific.

CONSTRUCTION:

Human Participation: Required for decisions.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: Model specific.

LIMITATIONS: None.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Replacement of the Relational Information Management RIM system with the ORACLE Relational Data Base Management System.

INPUT: Data for the following relations: Climb, Descend, Takeoff, Constant Air Cruise, Maximum Range Cruise Condition, Maximum Range Endurance , Drag, Aircraft Parameters.

OUTPUT: Data, plots of data, printouts.

HARDWARE AND SOFTWARE:

Computer: APOLLO DOMAIN.
Storage: 400,000 blocks.
Peripherals: Printers, graphics plotters, and digitizers.
Language: DOMAIN FORTRAN 77, UNIX, and RIM.
Documentation: Boeing published manuals.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Aircraft/Relations specific. Usually one man-week per aircraft.

CPU time per Cycle: Model specific. Can take hours of CPU time, but most sessions are quick.

Data Output Analysis: Used only to manage data.

Frequency of Use: Extensive access by simulation models.

Users: Tanker/Airlift group, BMA OA.

Comments: ADB is a data base and its supporting data management programs. The programs allow data plotting, query, review, appending, modification, access by external models, and management.

TITLE: ADB - Attrition Data Base for USAF Munitions Planning

MODEL TYPE: Analysis.

PROPONENT: AD/ENYS, Eglin AFB, FL 32542-5000.

POINT OF CONTACT: Mr. David E. Jeffcoat, (904) 882-9417, AV 872-9417.

PURPOSE: The ADB is used to select the "best" munition to perform a certain function. Data can also be used to evaluate the relative survivability of one weapon delivery profile to another or to do parametric studies to assess effects of changing variables in certain aspects of the attack. Other uses are to determine the best use of tactical aircraft by maximizing targets killed and minimizing aircraft losses.

DESCRIPTION:

Domain: Air.

Span: Theater.

Environment: Theater attack: day, night, and weather; first day, first wave only; mobile and fixed targets.

Force Composition: Enemy: SAM, AI, and AAA. Friendly: all tactical aircraft.

Scope of Conflict: Conventional.

Mission Area: Recognized combinations of weapons and procedures used to accomplish a specific objective. Close air support and battlefield air interdiction.

Level of Detail of Processes and Entities: BLUE: Single aircraft to flights of 24. RED: Total antiair threat laydown including SAM, AAA, AI, and EW.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, combination event-step and time-step model

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, nonreactive.

LIMITATIONS: Nonsensitive to low-observable aircraft technology; no terrain following capability for aircraft.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Incorporate low-observable methodology, automate input data updates, and add terrain following capability for aircraft.

INPUT: Aircraft vulnerability and performance characteristics, pilot reaction, digitized weapon delivery profiles, army deployment doctrine, and ADU performance characteristics.

OUTPUT: Paper output of raw attrition data by threat type, histograms of aircraft losses per replication, and attrition for specific attacks in available scenarios and time frames.

HARDWARE AND SOFTWARE:

Computer:	CYBER series with large core memory and NOS/BE operating system. VAX/VMS.
Storage:	28,000 blocks (14.336 megabytes).
Peripherals:	Remote terminal and printer.
Language:	FORTRAN V.
Documentation:	None.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1977.

Data Base: 8 months to prepare.

CPU Time per Cycle: Usually 1 hour CPU time per job.

Data Output Analysis: Postprocessor produces tabular data for analyses of raw data.

Frequency of Use: Varied by demand, usually 10 to 12 times per year.

Users: HQ USAF and other AF agencies.

Comments: Managed through annual conference of users. Updates and changes approved by committee. Data retrieval program presents tabular attrition data for attacks in available scenarios/time frames.

TITLE: ADMRALS - Attack and Defense of Maritime Resources in Adverse Locals Simulator

MODEL TYPE: Analysis, but has support exercise activities.

PROPONENT: Strategic Systems Department (K13), Naval Surface Warfare Center, Dahlgren, VA 22448-5000.

POINT OF CONTACT: Dr. A. D. Parks, (703) 663-8872.

PURPOSE: ADMRALS serves as a variable fidelity, integrated, naval multi-warfare engagement simulator that uses existing and newly developed software models. This system currently (and will in the near term) supports battle force architecture design and evaluation activities, which involves weapon system development and effectiveness, force capability and requirements, and combat doctrine and strategy development. ADMRALS is ultimately intended to be a training and education model (as well as an analysis model) that supports training and exercise tasks.

DESCRIPTION:

Domain: Sea, air, space, and undersea.

Span: Currently regional.

Environment: Weather, time of day, sea states.

Force Composition: Naval battle group structures (BLUE and RED).

Scope of Conflict: Conventional and conceptual (BLUE and RED).

Mission Area: Sea.

Level of Detail of Processes and Entities: Solely a function of models folded into system and selected for simulation case runs. For example, the entire simulation system can be used to model with great fidelity a single sensor and its environment, or, with lesser fidelity, the effectiveness of an entire fleet architecture that uses this sensor system.

CONSTRUCTION:

Human Participation: Not required. System is interruptable.

Time Processing: Dynamic, time-step, but intelligent processes can schedule future events based on current perceptions.

Treatment of Randomness: Hybrid, with certain functions modeled deterministically and others modeled stochastically. Entire system can be simulated using Monte Carlo techniques.

Sidedness: Two-sided with one side partially reactive.

LIMITATIONS: Function of the various models integrated into the system. Absolute limits have not yet been determined or approached.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Continuous evolution to include integration of antisubmarine, surface, strike and mine warfare; multiple battle groups; complete symmetry in sidedness; man-in-the-loop options; hardware-in-the-loop simulation capability; and remote site participation.

INPUT: Typically threat definition, battle force structure, hardware characterization, communication links, and tactical rule bases.

OUTPUT: All data pipelined to a large relational data base system for retention and analysis. Many standard reports are produced. Interactive data base queries can answer specific questions and generate special reports. Statistical packages can interact with data to derive statistical reports. All reports are either tabular or plots. Animated graphics system can display engagements during run or archive them for later review. Video tapes of these graphs can be made and supplemented with hardcopy reports.

HARDWARE AND SOFTWARE:

Computer:	TARDIS Distributed Processing System. A non-homogeneous distributed/networked processing environment using Ethernet/TCPIP, eight SUN 3/60s, one SUN 3/280, one SUN 3/260, one SUN 386I, five IBM PC/ATs, one IRIS 3030, two XEROX AI Workstations, one TEKTRONIX AI Workstation, six COMPAQ 386s (on order), one IRIS 40/20 (on order), one Barcographic 400 6' x 8' overhead projector (on order), and two Superminis.
Storage:	2.5 gigabytes (disk) available. Minimum required: .5 gigabytes.
Peripherals:	One HP Laser Jet printer, Star SR-15 line printer.
Language:	"C," FORTRAN, and Pascal.
Documentation:	N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987 (still evolving).

Data Base: One man-minute to one man-day depending on case complexity.

CPU time per Cycle: Case-dependent. A representative example is a 13,000-second engagement between a 4-carrier BLUE battle group (with 5 AEGIS cruisers, 4 Oilers, 10 frigates, 98 F14/F18s, and 4 E-2s used in engagement), and 175 RED bombers (cruise missile load out of 4-12 per bomber), and 3 red submarines that run at a 15-second time step in approximately 2.5 hours.

Data Output Analysis: Three man-hours to generate reports.

Frequency of Use: Current average use is 3-5 times per month.

Users: Naval Surface Warfare Center; SPAWAR 31.

Comments: The models used in this system are specified by SPAWAR 31 as standard evaluation and analysis models for independent warfare areas. The current area of emphasis of ADMRALS is the integrating and concurrent processing of separate warfare area models, although it is not limited to this application.

TITLE: ADS - Ammunition Distribution System

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Armament Munitions and Chemical Command, ATTN: AMSMC-DSP-1, Rock Island, IL 61299-6000.

POINT OF CONTACT: Mr. N. Hoesly AV 793-5980/5891 or Mrs. C.C. Carnegie, AV 793-4152.

PURPOSE: ADS is used to assess the logistics capabilities of the movement of CLASS V ammunition from the wholesale CONUS base. Various readiness analysis and logistics shortfalls can be determined in the transportation system.

DESCRIPTION:
Domain: N/A.

Span: N/A.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: ADS simulates the distribution of ammunition from CONUS depots and production plants to the overseas theaters during mobilization. Many processes are interfaced including requisitioning, production, storage, CONUS shipping by truck and rail, transocean shipping by air and sea, and in-theater movement to the forward ammunition supply points.

CONSTRUCTION:
Human Participation: Closed loop; human participation required to build data bases.

Time Processing: Dynamic, closed form.

Treatment of Randomness: Unknown.

Sidedness: One-sided.

LIMITATIONS: Unknown.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Unknown.

INPUT: Data Elements: ammunition requirements; ammunition assets; Ammunition Item Information Transportation Network. Data Sources: LPSA Logistics Program Support Activity; MTMC. Data Bases: CCSS data base; AMSA data base.

OUTPUT: Ammunition distribution plan; various reports depicting ammunition movements from depots, thru ports (CONUS and OCONUS), and to the ammunition supply points.

HARDWARE AND SOFTWARE:

Computer: PRIME 9955 Mod 2.

Storage: Unknown.

Peripherals: PRIME computer systems.

Language: FORTRAN IV, F77, CPL.

Documentation: ADS Executive Manual, ADS User Manual, ADS File Formats.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Takes several weeks.

CPU time per Cycle: Unknown.

Data Output Analysis: Produces hand copies of raw data.

Frequency of Use: Varies by command.

Users: Joint Chiefs of Staff, (JCS/J4), Logistics Evaluation Agency, and Industrial Engineering Activity.

Comments: This model is very complex and consists of many programs that are scheduled and processed to accommodate each study or analysis.

TITLE: ADTAM - Air Superior/Air Defense Tanker Analysis Model

MODEL TYPE: Analysis.

PROPONENT: Boeing Military Airplanes, Operations Analysis, Box 7730, M/S K80-33, Wichita, KS 67277-7730.

POINT OF CONTACT: John A. December, Boeing Military Airplanes, Operations Analysis, (316) 526-2956.

PURPOSE: The purpose of the ADTAM is to determine the tanker requirements for the refueling support of a continuous barrier patrol operation with intermittent forward excursions to engage and defeat intruders beyond the barrier.

DESCRIPTION:

Domain: Land and air.

Span: Global.

Environment: Distances.

Force Composition: Fighter force.

Scope of Conflict: Conventional.

Mission Area: Air Superiority/Air Defense.

Level of Detail of Processes and Entities: Entities: Individual aircraft. Processes: Single air refueling.

CONSTRUCTION:

Human Participation: Required to set up data files for execution.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Does not model aircraft loading, loading times, aborted air refuelings, or replacement aircraft.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Completion of model.

INPUT: Input fields are required to provide the following information: force specification (fighter types, fuel burn data, aircraft parameters, time on station requirements); and allocation option (type of tankers to potentially use, and costs).

OUTPUT: Output includes summary information on the number and types of aircraft used, fuel burn, and onload amounts; and detailed information on the times, distances, and fuel amounts for each orbit location.

HARDWARE AND SOFTWARE:

Computer: Developed to run in a network of APOLLO DN3000 and DN660 terminals running a AEGIS-DOMAIN/IX (Unit-based) operating system, software release 9.5.

Storage: Currently about 200K for the executable model. Data bases require additional space.

Peripherals: 1 printer, 1 terminal.

Language: APOLLO/DOMAIN Pascal and FORTRAN APOLLO DOMAIN/IX operating system calls, and RTIRIM data base management system that makes calls to Boeing Military Airplanes' Aircraft Data Base.

Documentation: Documentation of analysis using the portion of the model that computes data for unrefueled aircraft is available.

SECURITY CLASSIFICATION: Unclassified, but data could be classified.

GENERAL DATA:

Date Implemented: This model is presently being developed.

Data Base: Aircraft data base is established for many aircraft.

CPU time per Cycle: Model incomplete.

Data Output Analysis: Output reports include summary output and detailed output in chart form.

Frequency of Use: Used once for an analysis involving unrefueled aircraft.

Users: Boeing Military Airplanes, Operations Analysis, Tanker/Airlift Program Support.

Comments: N/A.

TITLE: Advanced Missile Model

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SASM), The Pentagon, Room 1D431, Washington, DC 20330-5420

POINT OF CONTACT: Maj David Knieriem, AFCSA/SASM, (202) 695-9018, AV 225-9018.

PURPOSE: AMM is designed to provide distance and footprint data of various missile configurations. This data can then be used to determine which force mix of land- and sea-based systems is better suited to provide deterrence. AMM also provides weapon system allocation based on the range and footprint of each missile system. It calculates the resulting probability of damage against each target.

DESCRIPTION:
Domain: Land, sea, and air.

Span: Global.

Environment: N/A.

Force Composition: RED and BLUE nuclear land and sea systems.

Scope of Conflict: World nuclear missile exchange.

Mission Area: N/A.

Level of Detail of Processes and Entities: N/A.

CONSTRUCTION:
Human Participation: Required to input the missile design specifications and for the conceptualizing of attack and exchange scenarios.

Time Processing: N/A.

Treatment of Randomness: N/A.

Sidedness: N/A.

LIMITATIONS: Cumbersome code makes the model difficult to work with. Considerable training is required before efficacious application is possible. Models single-sided attack or retaliation only. Multiple runs are required to accomplish a complete scenario.

PLANNED IMPROVEMENTS AND MODIFICATIONS:
a. Making the code more user friendly.
b. Transporting many of the AMM functions to microcomputers using UNIX V operating systems. This will eliminate using JCL intercommands.

INPUT: Missile designs and specifications, missile launch points, number and size of nuclear weapons, and targets (RED and BLUE).

OUTPUT: Range arc of missile and targets covered and probable damage.

HARDWARE AND SOFTWARE:

Computer:	IBM 3081 with MVS-XA.
Storage:	System requires 500 MB of storage.
Peripherals:	TSO terminals with SPF.
Language:	FORTRAN, COBOL, and JCL.
Documentation:	User's manual available.

SECURITY CLASSIFICATION: Source code is unclassified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Three to six man-months.

CPU time per Cycle: Variable; 10-150 CPU minutes.

Data Output Analysis: N/A.

Frequency of Use: Depends on analytic requirements.

Users: SASM.

Comments: None.

TITLE: AEM - Arsenal Exchange Model

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies & Analysis, Rm 1D376, The Pentagon, Washington DC 20301.

POINT OF CONTACT: LCDR Barrowman, (202) 697-8546, AV 227-8546.

PURPOSE: AEM has become one of the most widely used strategic force analysis models in the defense community. It was originally developed by the Martin Marietta Corporation in 1965 as an aid to understanding the TITAN weapon system. The AEM code has evolved over the years, and the model has developed into a general purpose force analysis model. It has been specifically designed to address strategic force analysis problems support such as strategic force capabilities studies, strategic nuclear policy support, arms control supporting analysis, force management analysis, and intelligence support. Recent developments have reflected more consideration of operational problems associated with weapons, needs to flexibly specify force objectives and constraints, needs for more detailed aspects of certain force situations, and needs for uncertainty analysis.

DESCRIPTION:

Domain: Ground- and sea-based strategic offensive and limited ground-based defense systems.

Span: Single-sided (but sequential) world strategic force application analysis.

Environment: Ground- and sea-based.

Force Composition: RED offensive missile threat and BLUE ground strategic defense system (or vice versa).

Type of Conflict: Strategic offensive nuclear and defensive exchange [illegible]

Mission Area: Strategic nuclear conflict.

Level of Detail of Processes and Entities: AEM is an aggregated two-sided strategic exchange model with a diverse set of scenario and analysis controls. AEM performs optimal allocations. Through the use of FROBAK (a FROnt end - BAcK end processor), weapon-to-target allocations can be investigated in a disaggregated manner.

CONSTRUCTION:

Human Participation: Analyst identifies the strategies and hedges for allocation, and prepares the weapons and targets information in the form of flat files. Program is almost always run in batch mode with an analysis consisting of tens and hundreds of runs.

Time Processing: Compile time is 10-20 minutes, and run time is 2-7 minutes per allocation unless extensive cross-targeting strategies are specified.

Treatment of Randomness: This is an expected value model.

Sidedness: Two-sided.

LIMITATIONS: The model can accommodate up to 50 weapon types that can be categorized by 100 names. Four hundred different target types are allowed, and up to 40 hedging constraints can be used to control the allocation. The model does not directly consider geography or range limits and does not model such factors as MIRVed system footprints, bomber refueling, and routing. Only prompt effects are considered when calculating damage, and only discrete waves are evaluated rather than a continuum of attack.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Geography, missile range, and footprinting (80% solutions) are in design phase.

INPUT: Target File: DGZ lat/long. Hedging constraints: weapons assignments. Weapons file: launch lat/long, number of weapons and characteristics. Defendable targets file: protected by ground defenses.

OUTPUT: Detailed weapons allocations summary damage expectancy calculations.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780 or better, APPOLLO, SUN, IBM, Honeywell, SEQUENT.
Storage:	Minimal for input; largest requirement is usually the storage of multiple case output files.
Peripherals:	None required; terminal or line printer for report review.
Language:	FORTRAN.
Documentation:	AEM User's Manual, Programmer's Manual, Management Summary.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1965.

Data Base: Supported by user-generated flat files.

CPU time per Cycle: Typical run times are less than two to seven minutes.

Data Output Analysis: In form of line printer reports. Also capable of producing spreadsheets to be used with 20/20 spreadsheet software on weapons allocated and damage expectancy.

Frequency of Use: Used daily.

Users: AF Studies & Analysis, The Joint Staff/J-8 NFAD, and many others.

Comments: None.

TITLE: AESOPS

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Analysis Activity (USAMSAA), Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: Mr. Dinsmore (301) 278-4973, AV 298-4973.

PURPOSE: AESOPS is a computerized, analytical, sustained operations model that simulates the operation of a helicopter unit over a period of several days of combat. It also introduces the impact of reliability, availability, maintainability, and combat damage repair of a helicopter type on unit availability during such operations. In addition, AESOPS can be used to analyze how various factors influence the dynamic operational readiness of the helicopters in sustained combat.

DESCRIPTION:

Domain: Air.

Span: Individual.

Environment: Unknown.

Force Composition: Units the size of a helicopter company.

Scope of Conflict: Conventional.

Mission Area: Close air support.

Level of Detail of Processes and Entities: Handles only one type of helicopter at a time. Solution techniques include probability theory and queuing theory.

CONSTRUCTION:

Human Participation: Not required, model not interruptable.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic, expected-value model.

Sidedness: Two-sided, asymmetric.

LIMITATIONS: AESOPS is an expected-value model that can handle only one type of helicopter at a time. It does not generate its own damage state probabilities, and it obtains its inputs from EVADE II.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Number of helicopters required for mission; time from receipt of mission request to take-off, time to fly to target, time between target attacks, and time between mission requests; reliabilities for various helicopter damage states (obtained from EVADE II); repair times for each degree of helicopter combat damage and routine maintenance; and number of targets defeated in the mission.

OUTPUT: Computer printout showing number of helicopters lost; targets defeated; number of missions accepted over the time period of interest; and number of helicopters under repair, awaiting repair, in flight, or operationally ready (in tabular or plot form). Attrition for any time interval of simulation is an optional feature.

HARDWARE AND SOFTWARE:

Computer: CYBER 173 (NOS 2.1).
Storage: 32K.
Peripherals: CALCOMP plotter.
Language: Fortran IV.
Documentation: Not complete.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1977.

Data Base: 1.5 man-months for preparation.

CPU time per Cycle: 40 seconds (per 8 days of combat).

Data Output Analysis: 0.5 man-month.

Frequency of Use: 15 times per year.

Users: USAMSAA and Ketron, Inc.

Comments: N/A.

TITLE: AFP Army Force Potential

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, Requirements Directorate, AFP Division, 8120 WOODMONT AVE, BETHESDA, MD 20814

POINT OF CONTACT: LTC Larry Wilkins, (202) 295-1444, AV 295-1444.

PURPOSE: The purpose of AFP is to quantify the capability of Army divisional units in order to measure over time the capability increases that result from modernization.

DESCRIPTION:
Domain: Land and limited close air support.

Span: Division level.

Environment: N/A.

Force Composition: BLUE and RED forces of division size.

Scope of Conflict: Conventional.

Mission Area: Direct fire battle, indirect artillery, and close air support.

Level of Detail of Processes and Entities: Models individual weapons in weapon-on-weapon conflicts through processes of detection, attrition, and indirect artillery effects. Individual conflicts occur with a variety of preplanned force ratios that represent the spectrum of force ratios expected on the battlefield.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Dynamic, time-step. Individual conflicts last for a predetermined length of time. Combat lasts for a predetermined number of days.

Treatment of Randomness: Stochastic. Detection and attrition processes are represented through Monte Carlo methods. Artillery effects are calculated deterministically.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Current model limit is 60 weapon types per side. There is no terrain representation.

PLANNED IMPROVEMENTS AND MODIFICATIONS: AFP will soon undergo a major upgrade to increase its efficiency, reduce its run time and storage requirements, and increase its analytical capability.

INPUT: Primary inputs are kill probability tables and preplanned BLUE-RED weapon pairings.

OUTPUT: Primary outputs are attrition tables and resulting force capability scores.

HARDWARE AND SOFTWARE:

Computer:	Runs on a Sperry 1100 computer.
Storage:	Approximately 280,000 words.
Peripherals:	Requires tape drive and printer.
Language:	FORTRAN.
Documentation:	Operator's and Programmer's Guide to the Analysis at Force Potential System (AFPSYS).

SECURITY CLASSIFICATION: Model is unclassified; input data is generally secret.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Two to three months.

CPU time per Cycle: One to two hours.

Data Output Analysis: Model postprocessors perform statistical analysis on model results.

Frequency of Use: Three to four times per year.

Users: U.S. Army Concepts Analysis Agency.

Comments: N/A.

TITLE: Agile

MODEL TYPE: Training and education.

PROPONENT: Air Force Wargaming Center (AFWC), Maxwell AFB, AL 36112.

POINT OF CONTACT: Col. T. Yax, AUCADRE/WGO, Maxwell AFB, AL 36112, (205) 293-6618, AV 875-6618.

PURPOSE: Agile, a seminar exercise driver, exposes players to the high-level decision-making process required to plan and execute a theater air campaign.

DESCRIPTION:

Domain: Land and air (includes carrier air operations) only.

Span: Central Europe.

Environment: Models day and night operations, as well as terrain and weather factors.

Force Composition: Combined force campaign where BLUE forces have operational control of air assets and limited control of selected ground units.

Scope of Conflict: Conventional only. Schedules, but does not play, nuclear weapon assets.

Mission Area: All conventional missions (no chemical or biological weapons).

Level of Detail of Processes and Entities: Agile extends control down to aircraft sorties. It does not permit play by tail number. Ground units maneuver at the division level.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, event-step. Progress determined by completion of both RED and BLUE force play inputs.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, asymmetrical. RED side normally played by a single player.

LIMITATIONS: No naval play except limited naval air.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Improved ground play, automated RED player, and enhanced graphics.

INPUT: The BLUE team has two phases. In the first, or AAFCE level, players form their apportionment and overall plan for the game. Input includes aircraft re-role, air and surface logistic movement, and aircraft bed-down. The second phase moves to the ATAF level, during which players input targeting and force package information.

OUTPUT: Printed reports are automatically generated at the end of each game day. There are over 200 pages reporting on virtually every aspect of game play. Agile provides reports in three primary areas: operations, intelligence, and logistics. Limited analysis is available to help players analyze their overall plan for the game.

HARDWARE AND SOFTWARE:

Computer (OS):	IBM compatible MS-DOS machine with floppy and hard disk drive storage, 640 KB random access memory and the 8087 math coprocessor.
Storage:	1.5 MB for executable and 0.5 MB for disk work space.
Peripherals:	Monochrome monitor (color optional) and printer required.
Language:	Lahey FORTRAN, PLink 86+ Linker.
Documentation:	User and maintenance manuals available.

SECURITY CLASSIFICATION: European scenario is unclassified.

GENERAL DATA:

Date Implemented: January 1988.

Data Base: 28 files in nearly 0.5 MB of storage. About two man-months required to replace data base.

CPU time per Cycle: N/A.

Data Output Analysis: Agile includes a monitor program to recover errors by both system and user.

Frequency of Use: Used at least once a year by each user.

Users: Air War College, Air Command and Staff, Canadian Forces Staff College, CEI Royal Air Force Staff College.

Comments: Managed through the review and configuration control board at the AFWC.

TITLE: AIRRAD - Fallout Prediction System

MODEL TYPE: Analysis.

PROPONENT: Atmospheric Sciences Laboratory, ATTN: SLCAS-AE-A, White Sands Missile Range, NM 88002-5501.

POINT OF CONTACT: Mr. David Sauter, (505) 678-2078, AV 258-2078.

PURPOSE: AIRRAD is used primarily to determine the dimensions of the nuclear hazard to low flying aviators from single threat nuclear attacks due to the close-in fallout. It is mainly an operation support tool, although it can also be used as a research and evaluation tool.

DESCRIPTION:

Domain: Land and air.

Span: Regional.

Environment: Models effects of weather but not terrain.

Force Composition: N/A.

Scope of Conflict: Nuclear.

Mission Area: Those involving nuclear usage.

Level of Detail of Processes and Entities: Effects on individual aircraft are modeled through the input of aircraft-specific flight characteristics such as flight speed.

CONSTRUCTION:

Human Participation: Required for decisions (waited for).

Time Processing: Dynamic, time-step.

Treatment of Randomness: Basically deterministic.

Sidedness: N/A.

LIMITATIONS: No complex, terrain influenced wind.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Meteorological variables and pertinent parameters describing the nuclear attack (e.g., height of burst, burst yield, etc.).

OUTPUT: Printout of length, width, and height of the nuclear hazard to aviators; graphic display of radiation contours at different heights; and accumulated dosage along user-specified flight paths.

HARDWARE AND SOFTWARE:

Computer: IBM PC or compatible.
Storage: 350 KB on a floppy diskette.
Peripherals: Printer (optional) and a graphics terminal.
Language: Turbo Pascal.
Documentation: Technical report/users guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Already exists or can be easily obtained.

CPU time per Cycle: Negligible; runs on a PC in minutes.

Data Output Analysis: None; results are easily understood.

Frequency of Use: Variable.

Users: Defense Nuclear Agency and Atmospheric Sciences Laboratory.

Comments: None.

TITLE: ALARM - Advanced Low Altitude Radar Model

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. William McQuay, (513) 255-2164.

PURPOSE: ALARM is a research and evaluation tool that evaluates the effectiveness of various aircraft configurations against selected air defense systems. ALARM provides an output of S/I values along a flight path or a detection contour plot.

DESCRIPTION:

Domain: Land and air.

Span: Local and individual.

Environment: Terrain relief.

Force Composition: One-on-one engagements.

Scope of Conflict: Pulsed radars, pulsed Doppler radars, and continuous wave radars.

Mission Area: Conventional missions involving radar aircraft engagements.

Level of Detail of Processes and Entities: ALARM uses the radar range equation approach (i.e., this is not a signal level simulation). The radar system description contains transmitter, receiver, and radar antenna characteristics. The environment describes ground clutter characteristics, clutter masking, multipath, atmospheric refraction, and jamming cross section. The target describes the target's flight path and radar cross section. Both onboard and standoff jamming systems are also modeled. This model provides the detection performance of ground-based radar systems against aircraft targets.

CONSTRUCTION:

Human Participation: Not required; model is not interruptable.

Time Processing: Dynamic, closed form.

Treatment of Randomness: Basically deterministic; statistical clutter calculations.

Sidedness: One-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Radar, target, jamming characteristics; onboard jammer antenna pattern data; target flight path data.

OUTPUT: Signal to interference ratio data, contour plot data, SPEED (another model) output file, very specific radar and target geometry and signal data.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780 with VMS 4.0 and floating point accelerator.
Storage:	1,209 blocks in 71 files.
Peripherals:	Device for plotting GKS graphics.
Language:	FORTRAN 77.
Documentation:	User's manual, Pulse to Pulse User's Manual, Site Specific User's Manual, and Preprocessor interface document.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: 15 minutes needed to prepare data base.

CPU time per Cycle: Average of 24.61 CPU seconds (varies with input parameters).

Data Output Analysis: Hard copies of data. Plot routine needed to display plot data.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

<u>TITLE</u>: ALARMPP - Pulse-to-Pulse Version of the Advanced Low Altitude Radar Model with Site-Specific Terrain

<u>MODEL TYPE</u>: Analysis.

<u>PROPONENT</u>: Science Applications International Corporation (SAIC).
400 Franklin Rd, Suite 200, Marietta, GA 30067

<u>POINT OF CONTACT</u>: Mark D. Bond, SAIC, (404) 426-9359.

<u>PURPOSE</u>: The purpose of ALARMPP is to aid the radar systems analyst in the study of radar detection phenomenology.

<u>DESCRIPTION</u>:

<u>Domain</u>: Land and sea.

<u>Span</u>: One aircraft on the radar.

<u>Environment</u>: Associated off-line program builds a mask file from Defense Mapping Agency terrain elevation data for use in target masking and clutter calculations.

<u>Force Composition</u>: Single element BLUE vs. RED or RED vs. BLUE.

<u>Scope of Conflict</u>: Accommodates any type of electronic warfare, target acquisition, or tracking radar. Includes tracking loops methodology and an error-nulling feedback algorithm designed to simulate monopulse angle as well as range and doppler tracking.

<u>Mission Area</u>: Single penetrator with jammer against a single radar.

<u>Level of Detail of Processes and Entities</u>: Lowest entity modeled is a radar subsystem: transmitter, pulse doppler or MTI circuit, noncoherent integrator, gain control. Pulse doppler and MTI processing implemented as actual system software.

<u>CONSTRUCTION</u>:

<u>Human Participation</u>: Not required or permitted.

<u>Time Processing</u>: Dynamic real-time emulation.

<u>Treatment of Randomness</u>: Deterministic; random noise implemented in both phase and amplitude.

<u>Sidedness</u>: Symmetric.

<u>LIMITATIONS</u>: Does not model range tracking.

<u>PLANNED IMPROVEMENTS AND MODIFICATIONS</u>: Moving target detector (MTD: MTI followed by pulse doppler) capability and extended target and range tracking will be added.

<u>INPUT</u>: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on VAX computer with a VMS operating system.
Storage:	ALARMPP executable = 125,000 bytes Input files = 75,000 bytes each (including antenna patterns) Mask files = 65,000 each (1 deg x 1 deg) Terrain executable = 30,000 bytes TERMSK executable = 23,000 bytes ALARMPP terrain elevation data files = 500,000 each (1 deg x 1 deg) DMA terrain elevation files = 1,500,000 bytes each (1 deg x 1 deg)
Peripherals:	No peripheral support required for operation. A graphics display terminal to view templates is recommended.
Language:	FORTRAN.
Documentation:	A user's manual and input guide are available.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Data base construction time is minimal provided that preparation is performed by a qualified radar analyst.

CPU time per Cycle: Depends on purpose; may range from several CPU minutes to several CPU hours.

Data Output Analysis: Extensive knowledge of radar processing required.

Frequency of Use: Extensive use by airframers in analysis of low observables (LO) design.

Users: N/A.

Comments: Configuration is controlled by SAIC.

TITLE: ALARMSS - Advanced Low Altitude Radar Model with Site-Specific Terrain

MODEL TYPE: Analysis.

PROPONENT: Electronic Combat Digital Evaluation Simulation Center, Wright-Patterson Air Force Base (WPAFB), OH 45433-6543

POINT OF CONTACT: Mark D. Bond, Science Applications International Corporation (SAIC), (404) 426-9359

PURPOSE: The purpose of ALARMSS is to determine the detectability of an aircraft with a given cross section in an environment with limited clutter. Detection templates for user input aspect angles around the aircraft are often fed to mission-level and campaign-level models such as SPEED and COMMANDER.

DESCRIPTION:

Domain: Land and sea.

Span: One aircraft or one radar.

Environment: An associated off-line program builds a mask file from Defense Mapping Agency (DMA) terrain elevation data for use in target masking and clutter calculations.

Force Composition: Single element BLUE vs. RED or RED vs. BLUE.

Scope of Conflict: Accommodates any type of electronic warfare, target acquisition, or tracking radar, although tracking radar is limited to detectability only. Aircraft are represented by Swirling/Barton theoretical fluctuation models.

Mission Area: Single penetrator with jammer against a single radar.

Level of Detail of Processes and Entities: Lowest entity modeled is radar subsystem: transmitter, pulse doppler or MTI circuit, noncoherent integrator, gain control. Pulse doppler and MTI processing limited to single spectral return in user-defined filter. Target fluctuation models limited to Swerling 1-4, Chi-squared, Weinstock, and nonfluctuating. Clutter reflectivity data is from Lincoln Labs; limited to 9 types of land form and 5 types of land cover to form 45 combinations of land state.

CONSTRUCTION:

Human Participation: Not required or permitted.

Time Processing: Dynamic, closed form solution. Determines detectability of aircraft of constant heading for 0-360 degrees viewing aspect angle over a user-specified distance.

Treatment of Randomness: Deterministic; random noise sums to the mean (deterministic) over an integration period.

Sidedness: Symmetric.

LIMITATIONS: Does not model angle, range, or doppler tracking. Target fluctuation limited to Swerling models 1 4, Chi squared, Weinstock, or nonfluctuating.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Moving target detector (MTD: MTI followed by pulse doppler) and monopulse angle tracking will be added. Integration period algorithms for coherent jamming will be designed.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on VAX with VMS operating system.
Storage:	ALARMSS executable = 80,000 bytes. Input files = 75,000 bytes each (including antenna patterns). Mask files 65,000 each (1 deg x 1 deg). Terrain executable - 30,000 bytes. THERMSK executable = 23,000 bytes. ALARMSS terrain elevation data files = 500,000 each (1 deg x 1 deg). DMA terrain elevation data files = 1,500,000 bytes each (1 deg x 1 deg).
Peripherals:	No peripheral support required for operation. A graphics display terminal to view templates is recommended.
Language:	FORTRAN.
Documentation:	A user's manual and input guide are available.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Data base construction time is minimal provided that preparation is performed by a qualified radar analyst.

CPU time per Cycle: Depends on number of simulation points. A 100 km range simulation performed at 1-degree intervals would require approximately 5 CPU minutes on a 4-MIP machine.

Data Output Analysis: Depends on level of engineering skills.

Frequency of Use: Extensive use by airframers in the analysis of low observables (LO) design.

Users: N/A.

Comments: Configuration is controlled by SAIC under contract to the Electronic Combat Digital Evaluation Systems at WPAFB, Ohio.

TITLE: ALB-XMOD

MODEL TYPE: Analysis.

PROPONENT: Vector Research, Incorporated, P.O. Box 1506, Ann Arbor, Michigan 48106.

POINT OF CONTACT: George Miller, (313) 973-9210.

PURPOSE: ALB-XMOD is a research and evaluation tool designed for dealing with combat development issues (alternative doctrinal concepts). It has also been used to address issues of force capability and requirements (e.g., force structure issues).

DESCRIPTION:

Domain: Land and air.

Span: Can vary from division through theater.

Environment: Terrain cells of a width sufficient to conduct an independent defense (of approximately battalion size) distinguish differences in battlefield trafficability and intervisibility. Terrain features such as rivers and urban areas can also be represented. Weather conditions, which are uniform throughout the battlefield and are updated each hour, can affect both trafficability and visibility for air and ground operations.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All conventional AirLand combat mission areas, with limited treatment of combat service support missions.

Level of Detail of Processes and Entities: Unit resolution is user specified (e.g. battalion maneuver unit resolution for corps-level scenario). In tactical air operations, resolution is to user-specified individual flight group (typically two to four aircraft). In most process modeling, the level of system resolution is the individual system type in the unit.

CONSTRUCTION:

Human Participation: The model can operate in either of two modes. In one mode, human participation is used for high level decisions describing an operational concept. Once an operational concept has been developed, campaigns can be replayed without gamers, varying individual details for analysis purposes.

Time Processing: Dynamic, time-step and event-step model. Eight nested clocks are used to reduce execution time while allowing statuses to be updated at appropriate frequencies.

Treatment of Randomness: Deterministic. Generates a value as a function of an expected value.

Sidedness: Two-sided, symmetric.

LIMITATIONS: No naval, chemical, biological, or nuclear warfare. Limited treatment of logistics.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: System performance capabilities; initial force and supply inventories and organizational data, and a schedule of unit and resource arrivals; data describing the environment; tactical decision rules; and initial intelligence information.

OUTPUT: The total trajectory of all important statuses (missions and activities, force inventories and attrition, unit locations and movement, supply deliveries and consumption, etc.) during a campaign are stored by the model for later summary and display by postprocessors.

HARDWARE AND SOFTWARE:

Computer:	Most applications have been conducted on a Concurrent minicomputer.
Storage:	Approximately 2.5 MB.
Peripherals:	No special peripherals are required.
Language:	FORTRAN.
Documentation:	Extensive documentation exists for the basic underlying model (VECTOR-2). Summary documentation describes modifications to this model resulting in ALB-XMOD.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Data modifications to an existing scenario for a new study typically require one to a few person months of effort, depending on the extent of the changes. Development of an entirely new scenario can require a person year or more.

CPU time per Cycle: 15 minutes to 2.5 hours per day of simulated combat, depending on computer.

Data Output Analysis: One to several person days of effort are required for a thorough analysis of the results of a several-day, corps-level run.

Frequency of Use: One or two studies per year.

Users: VRI has used ALB-XMOD for several U.S. Army agencies and for the National Defense University.

Comments: ALB-XMOD was developed from VECTOR-2 to incorporate Army AirLand Battle doctrine and tactics. The basic physical process models of VECTOR-2 were unchanged, but the capability to represent new tactical doctrine was incorporated. Added features include new and improved play of BLUE offensive operations, including counteroffensives at tactical and operational levels; deep attack by maneuver forces and helicopters; improved synchronization of efforts around objectives; and an expert/gamer interface.

TITLE: ALEx - Aircraft Loading Expert

MODEL TYPE: Analysis.

PROPONENT: Operations Analysis (OA) Unit, Boeing Military Airplanes (BMA), P.O. Box 7730, M/S k80-33, Wichita, KS 67277-7730.

POINT OF CONTACT: John E. Huffman, (316) 685-9669.

PURPOSE: ALEx determines feasible aircraft store loading configurations based on certain mission parameters. ALEx operates within the Knowledge Engineering Environment (KEE). The information on weapons, external tanks, pods, and suspension units is accessed by simulation models.

DESCRIPTION:
Domain: Model specific. (Supports air-to-air, air-to-surface, and special missions.)

Span: Model specific.

Environment: Model specific. (Supports many target and air environments.)

Force Composition: Model specific.

Scope of Conflict: Conventional weapons.

Mission Area: Combinations include close air support, air interdiction, sea control, airlift, and air refueling.

Level of Detail of Processes and Entities: Entity: Aircraft, external stores. Processes: Model specific.

CONSTRUCTION:
Human Participation: Required for decisions.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: Model specific.

LIMITATIONS: Limited by the domain and knowledge frame.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Stores driver for configuration control. Addition of other U.S. Air Force and U.S. Navy aircraft.

INPUT: Missions data includes length, aircraft, air environment, target environment, and standoff support.

OUTPUT: Loading configurations, store components, weights, and drags.

HARDWARE AND SOFTWARE:

Computer: APOLLO DOMAIN.
Storage: 400,000 blocks.
Peripherals: Printers and graphics plotters.
Language: DOMAIN COMMON LISP, KEE, and UNIX.
Documentation: Boeing published manuals.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Aircraft/Relation specific. Usually two man-weeks per aircraft.

CPU time per Cycle: Model specific. Can take hours of CPU time, but most sessions are quick.

Data Output Analysis: Used only to manage information accessed by models.

Frequency of Use: Extensive access by simulation models.

Users: Tanker/Airlift group, BMA OA.

Comments: ALEx is a modular expert system that accesses aircraft knowledge bases. Current knowledge bases have been developed for multiple versions of the F-15, F-16, and F-14 fighters. Development of the F-18 knowledge-base is in progress. Future development for most USAF and USN fighters and bombers.

TITLE: ALWSIM III - Army Laser Weapon Simulation Model

MODEL TYPE: Force-on-force or many-on-many.

PROPONENT: HQ, U.S. Army Laboratory Command (LABCOM).

POINT OF CONTACT: HQ, U.S. Army LABCOM, ATTN: AMSLC-TP-AS (CPT Mike Barton), 2800 Powder Mill Rd., Adelphi, MD 20783-1145, (301) 394-4650/2410/2411, AV 290-4650/2410/2411.

PURPOSE: ALWSIM III, originally developed by GRC in 1981/1982 to model the use of lasers on the modern battlefield, is now also ideal for parametric analysis of both laser and nonlaser next generational and notional systems.

DESCRIPTION: Computerized simulation of a brief, intense close combat situation based on realistic battlefield environment (HRS 1) using digitized terrain data. Plays obscuration due to artillery dust and smoke (EOSAEL 87), emphasizing accurate modeling of low-energy laser weapons. Utilizes armor, aviation, dismounted infantry (and their weapons), close air support, air defense, and fire support in a BLUE battalion vs. RED regimental battle. Other scenarios can be developed. Uses Carmonette terrain representation, LOS algorithms, vehicle movement modeling approach, and basic NVEOL target acquisition code, LELAWS, for laser damage determination; PHI for active acquisition modeling; and ADAGE incursion model for air defense weapon effects modeling.

Domain: Land warfare.

Span: 100 m x 100 m grid squares in a 16 square km section.

Environment: Land.

Force Composition: BLUE battalion vs. RED regiment.

Scope of Conflict: Conventional.

Mission Area: Force-on-force land warfare.

Level of Detail of Processes and Entities: Casualty figures given by single vehicles; round-by-round description of effects of firing; damage to individuals; movement is by groups but systems fire individually.

CONSTRUCTION:

Human Participation: None.

Time Processing: Dynamic, mainly event-step but some time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided.

LIMITATIONS: EOSAEL 80 is used in the model. The air-air and ground-air battle not fully developed. Fixed wing aircraft not fully utilized in battle; mainly used to drop ordinance on ground units. Logistics and communications not played.

PLANNED IMPROVEMENTS AND MODIFICATIONS: A SOW is being initiated to update EOSAEL 80 to EOSAEL 87 and to provide ALWSIM III to AMSAA to operate on a UNIX VAX. The Survivability Management Office plans to upgrade the ground-air and air-air aspects with a joint SOW between KETRON and SPARTA, INC.

INPUT: When HRS1 scenario used, inputs required in following categories: vehicle, weapon, sensor, and laser characteristic; pK tables for all weapon systems; movement rates; and environmental data (default or user input).

OUTPUT: Troubleshooting reports help debug program. Battle summaries are of: conventional, direct fire kills; indirect fire kills; kills by fixed wing aircraft; laser engagement assessments; laser engagement results; ammo depletion; laser weapon effectiveness; force-on-force effectiveness; and conditions at battle termination. A report is prepared for the replication only that provides a summary of conventional, direct fire weapon firings; a breakdown of firings and kills by weapon/target type; a summary of laser weapon firings; and force dispositions at battle termination.

HARDWARE AND SOFTWARE:

Computer:	VAX with VMS operating system or CONVEX C-1, unvectorized.
Storage:	N/A.
Peripherals:	Standard keyboards and printer.
Language:	FORTRAN is the basic language. A version of FORTRAN, CIFTRAN, is facilitates running the model.
Documentation:	User's manual, user's guide, and analyst guide.

SECURITY CLASSIFICATION: Unclassified without data. Model uses a classified reference sheet (secret) that enables the user to run the model in an unclassified mode even with the data input.

GENERAL DATA:
Time Requirements: 3600/iteration to run HRS1, a 20 min. BLUE battalion vs. RED regimental battle. Ten to 20 iterations per case required.

Date Implemented: August 1989.

Data Base: Two man-months.

CPU time per Cycle: Seven minutes for 20-minute battle.

Data Output Analysis: Printout.

Frequency of Use: N/A.

Users: HQ, U.S. Army LABCOM, NVEOL and CECOM (2Q FY 89), and AMSAA (3Q FY 89).

Comments: Architecture: it is not interactive. Processes are modeled as discrete events occurring instantaneously by sampling assumed distributions. Repetition of simulated battle yields distribution of outcomes. A simulation clock proceeds from event to event rather than in fixed steps. Simulation inputs are provided either by user in a data base or by recognized subroutines. A developed scenario uses preplanned movement routines for air and ground vehicles, artillery fires, and obstacles.

TITLE: AMM - Army Mobility Model

MODEL TYPE: Analysis (primarily a vehicle mobility evaluation model).

PROPONENT: Mobility Systems Division, Geotechnical Laboratory, U.S. Army Engineer Waterways Experiment Station, P.O. Box 631, Vicksburg, MS 39181-0631.

POINT OF CONTACT: Mr. Newell Murphy, (601) 634-2447; Mr. Donald Randolph, (601) 634-2694.

PURPOSE: AMM predicts and compares mobility capabilities of candidate ground vehicles for operation in selected areas of the world. It evaluates mobility capabilities in the military ground vehicle acquisition process and can be used in course-of-action and vehicle mix evaluation and in resource planning.

DESCRIPTION:

Domain: On and off-road area (forests, farmlands, etc.) and across gaps.

Span: Useful from individual vehicle or soldier level up to corps level.

Environment: Off-road area terrain ordinarily mapped in raster, roads and linear features in vector, and urban areas in raster or vector. Each type of terrain is described by factors that significantly influence mobility (e.g., soil strength, slope, surface roughness, vegetation, visibility, obstacles for off-road area terrain). Overall terrain description can be developed from TTADM, ITD, or similar terrain data bases produced by the Defense Mapping Agency. Models day and night mobility and weather effects on historical, near-real-time, and forecast bases.

Force Composition: From single vehicles to vehicle mixes. Joint and combined forces, RED and BLUE.

Scope of Conflict: Can adjust vehicle mobility relative to battlefield damage. Rules can be set for restricting or eliminating mobility as a function of conventional, unconventional, or nuclear warfare.

Mission Area: All missions involving U.S. military ground vehicle mobility.

Level of Detail of Processes and Entities: Lowest entity is single vehicle or soldier, up to mixes of vehicles. Processes are primarily deterministic based on field-validated relations. Monte Carlo procedures are used in a limited way in terrain and historical weather data interpretation. Mobility on road, off road, and across gaps is modeled ina modular software format that compares pertinent vehicle and driver capabilities with those necessary to satisfy specified terrain, weather, and mission requirements. Outputs can be used to evaluate avenues of approach, gap crossing sites, vehicle optimum mix, cross country routes, etc.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, event step.

Treatment of Randomness: Mobility treated in deterministic fashion, terrain and historical weather by measured data, then limited Monte Carlo procedures.

Sidedness: Two-sided, symmetric. Single operator or multiple operators.

LIMITATIONS: Limited capability to model mobility in snow, avenues of approach, effects of military-emplaced obstacles, and formation movement. Does not model engineer-assisted gap crossing or cover and concealment.

PLANNED IMPROVEMENTS AND MODIFICATIONS: In process of removing limitations and enhancing model capabilities.

INPUT: Prescribed digit8ized data describes vehicles, driver, terrain, weather, and scenario factors that have significant effect on ground vehicle mobility for specified mission requirements.

OUTPUT: Maps, tabulations, and analyzed data are used to compare mobility capabilities of military ground vehicles and to evaluate mobility capabilities of competing ground vehicles in the military acquisition process.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on VAX computers with VMS operating systems.
Storage:	70,000 blocks (35 MB).
Peripherals:	Minimum one terminal; can drive printers and graphics terminals.
Language:	FORTRAN 77.
Documentation:	Limited documentation.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1971.

Data Base: For one quad sheet (22 km x 23 km), all terrain factors and ordinary resolution (100 m for off-road terrain, 10 m for roads and linear features); digitizing requires about one man-month. Vehicle, driver, and historical weather data is preprocessed and requires limited preparation time.

CPU time per Cycle: About two minutes for one quad and normal terrain data resolution.

Data Output Analysis: Postprocessor provides graphical and textual information useful primarily in comparing the capabilities of available ground vehicles and in evaluating mobility capabilities in the military ground vehicle acquisition process.

Frequency of Use: Varies; used at least several times per year.

Users: U.S. Army Training and Doctrine Command, Tank-Automotive Command, Material Systems Analysis Agency, Foreign Science Technology Center, U.S. Army Engineer Waterways Experiment Station.

Comments: Upgraded regularly. Closely aligned with NATO Reference Mobility Model (NRMM).

TITLE: ANGEL - Aids to Navigation Event-Step Logistics Model

MODEL TYPE: Analysis.

PROPONENT: Coast Guard Research and Development Center, Avery Point, Groton, CT 06340-6096.

POINT OF CONTACT: Leonard Kingsley, (203) 441-2649, FTS 642-2649.

PURPOSE: The ANGEL simulation model was developed to evaluate alternative buoy tender designs of differing characteristics in realistic operational environments.

DESCRIPTION:

Domain: Coastal and ocean.

Span: Can be used for any region for which required data is available.

Environment: Uses simulated sea state and visibility data.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: A tender's activities are broken up into several processes: docked transit, anchored, working buoys. The process the tender undertakes depends on a series of decision variables (e.g., tender location, current tender state, sea conditions, buoy maintenance schedule).

CONSTRUCTION:

Human Participation: Only required for initiating a simulation run. Program is not designed to interact with user during processing phase. All decisions including the routing of the tender are taken care of within the program.

Time Processing: N/A.

Treatment of Randomness: The sea state is modeled by several Markov matrices, one for each month, determined using NOAA buoy data. The visibility is modeled by multiple Markov matrices, by month and by 3 hour time periods in a day, determined using local airport data.

Sidedness: N/A.

LIMITATIONS: Single mission (ATON) and single tender working a given set of buoys.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Adding logistics capability and a process for maintenance of the tender itself. Knowledge Support System is being developed as a front end to enhance user-friendliness.

INPUT: Polygons outlining navigable waters for the tender within the region being simulated, external event weather files regarding wave height and visibility for the region, tender characteristics, port data, and buoy data.

OUTPUT: MOE report, animated graphics, raw data to be used in Postprocessor.

HARDWARE AND SOFTWARE:

Computer:	VAX computer with VMS operating system. Suggest using a machine with 2.7 MIPS or greater, dedicated if possible.
Storage:	Dependent upon the number of tenders and regions involved.
Peripherals:	N/A.
Language:	SIMSCRIPT II.5, FORTRAN.
Documentation:	Fully commented code, analyst-level report, programmer level installed in the Knowledge Support System.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: N/A.

CPU time per Cycle: Dependent upon data base size, the length of time being simulated, and the computer system being used. Using a 2.7 MIP dedicated VAX workstation to make 30 iterations of 365 day spans (field of buoy size was 156), it takes about 12 hours to complete per tender.

Data Output Analysis: N/A.

Frequency of Use: N/A.

Users: N/A.

Comments: None.

TITLE: APM Advanced Penetration Model

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SASB), The Pentagon, Room 1D431, Washington, DC 20330-5420.

POINT OF CONTACT: Maj Terry Young, AFCSA/SASB, (202) 695-3599, AV 225-3599.

PURPOSE: The APM is a theater-level, complex, digital simulation of conflict between U.S. penetrators and enemy defenses. It is used to identify force structures that are most effective against a range of defenses.

DESCRIPTION:

Domain: Land and air.

Span: Global.

Environment: Smooth earth (radar clutter accounted for by applying degrade to radar).

Force Composition: BLUE strategic nuclear air-breathing forces vs. RED defensive forces (SUAWACS, EW/GCI, AIs, and SAMs).

Scope of Conflict: Nuclear.

Mission Area: Strategic nuclear bombardment.

Level of Detail of Processes and Entities: APM can track individual penetrators from launch through Airborne Warning and Control System, EW, GCI, and interceptor SAM coverage and from the target areas to recovery bases. It models each penetrator's exposure to radar, calculates the results of any engagement that occurs, and then aggregates the results for the entire force.

CONSTRUCTION:

Human Participation: Required for refinement of mission plan. Mission planning is an iterative process. Each run is checked for reasonableness, then adjusted and rerun as necessary. Human participation is not required for air battle.

Time Processing: Dynamic, event-step.

Treatment of Randomness. Uses both deterministic and Monte Carlo techniques. Events such as entrance into and exit out of radar and SAM coverage and fighter commitment are the result of geographic and spatial relationships. However, the actual detections and kills by fighters and SAMs are determined by Monte Carlo techniques.

Sidedness: Two-sided, asymmetric, one side nonreactive (penetrator is routed around known threats, but does not react to unbriefed threats).

LIMITATIONS: Interrelated data structures and complex, cumbersome code make the model very difficult to work with. Considerable analyst experience is required to adjust model and data to represent low observables.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None--model is being archived.

INPUT: RED and BLUE force descriptions including locations; capabilities; one-on-one probabilities of detection, conversion, and kill; and degrades to these probabilities due to various countermeasures.

OUTPUT: Plots of sortie tracks, survivability and engagement reports, and output data banks of categorized information that the user can statistically analyze.

HARDWARE AND SOFTWARE:

Computer:	IBM 3081 with MVS-XA.
Storage:	The largest module requires 8000K of core.
Peripherals:	TSO terminals with SPF, Calcomp drum plotter, an IBM P3800 laser printer, and the capability to send output to microfiche.
Language:	Majority is FORTRAN.
Documentation:	User's guide available.

SECURITY CLASSIFICATION: Source code is unclassified.

GENERAL DATA:

Date Implemented: 1972.

Data Base: Three to five man-months.

CPU time per Cycle: Mission planner modules take from 15 to 180 CPU minutes. The simulator module generally requires 120 CPU minutes.

Data Output Analysis: Varies.

Frequency of Use: Varies depending on SASB analytic requirements.

Users: SASB.

Comments: None.

TITLE: Application of Error Analysis to Target Location System

MODEL TYPE: Analysis.

PROPONENT: CECOM AMSEL-PL-SA, Fort Monmouth, NJ 07703-5000.

POINT OF CONTACT: Mr. Edwin Goldberg, (201) 532-3646, AV 992-3646.

PURPOSE: This research and evaluation tool computes the elliptical errors associated with target location by angle of arrival measurements made at two sensor locations.

DESCRIPTION:

Domain: Any combination of the identified items.

Span: Local.

Environment: Capability limited by terrain features.

Force Composition: Component and element

Scope of Conflict: Conventional.

Mission Area: Air, land, and sea.

Level of Detail of Processes and Entities: Two sensor systems.

CONSTRUCTION:

Human Participation: Required to provide input data.

Time Processing: Static.

Treatment of Randomness: Stochastic, direct computation.

Sidedness: One-sided.

LIMITATIONS: Single target.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Angle measurement error of sensors, self location error of sensors, placement of sensors, and location of emitters.

OUTPUT: Elliptical error geometry and estimate of circular error probable.

HARDWARE AND SOFTWARE:

Computer:	Any.
Storage:	Minimum storage required.
Peripherals:	Printer.
Language:	FORTRAN.
Documentation:	"A Case for Error Analysis," Proceedings, 24th Annual U.S. Army Operations Research Symposium 1985 and "Application of Error Analysis to Target Locating Systems," Proceedings, 25th Annual U.S. Army Operations Research Symposium 1986.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: N/A.

CPU time per Cycle: Negligible.

Data Output Analysis: Computer output is self-instructive and complete.

Frequency of Use: N/A.

Users: CECOM, Fort Monmouth, NJ.

Comments:

TITLE: APS Ammunition Point Simulation

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Ordnance Missile and Munitions Center and School, Attn: ATSK-CTA, Redstone Arsenal, AL 35897.

POINT OF CONTACT: Mr. Leon Jones, (205) 876-8420/8493, AV 746-8420.

PURPOSE: APS is used to analyze the impact or organizational (e.g. new TOEs) and structural (e.g. physical and geographical positioning) changes upon an ammunition supply node.

DESCRIPTION:

Domain: Abstract.

Span: Local.

Environment: Day/night operations.

Force Composition: Any from company through corps.

Scope of Conflict: Anything desired.

Mission Area: Ammunition logistics.

Level of Detail of Processes and Entities: Degree of resolution is the individual ammunition DODIC. All organizational details of an ammunition supply node (TP, ASP, CSA, or TSA) are portrayed and affect the throughput of ammunition. Degradation factor is introduced for night operations. Demand upon the supply point is generated by external sources (usually TRADOC Standard Scenario Task Organization).

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Convoy generation is deterministic (no randomness). The remainder of the model is stochastic (direct computation). The model can be run in Monte Carlo mode.

Sidedness: One-sided.

LIMITATIONS: Maximum of 25 line items of ammunition portrayed, no more than handling equipment (MHE), maximum of 60 Field Storage Units.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The development of a preprocessor is being considered.

INPUT: Unit force structure, types and quantities of trucks, scenario length, data collection intervals, data elements to collect, and ammunition unit organization (people and MHE).

OUTPUT: Plots and printouts of ordered, organized data and statistics.

HARDWARE AND SOFTWARE:

Computer:	IBM PC compatible with math coprocessor operating in MS-DOS.
Storage:	20 MB.
Peripherals:	Printer.
Language:	FORTRAN.
Documentation:	Ammunition Point Simulation (APS) User/Programmer Manual (Books 1 & 2), Armament Systems, Inc., Feb 83 and Division Ammunition Management Simulator (DAMS) User/Programmer Manual, Strategic Financial Planning Systems, Inc., Dec 87.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1982.

Data Base: Averages 90 minutes, but could take much longer depending on the degree of revision.

CPU time per Cycle: Seven-day run in 60 minutes.

Data Output Analysis: Hard copy printouts containing data flagged in the input process. Some statistical analysis completed by postprocessor.

Frequency of Use: Often used daily but on the average used weekly.

Users: OMMCS.

Comments: N/A.

TITLE: ARTBASS - ARmy Training BAttle Simulation System

MODEL TYPE: Training and education.

PROPONENT: CATA, ATZL-TAT-B, Ft. Leavenworth, KS 66027.

POINT OF CONTACT: Mr. Kenneth W. Bernard, GM14, (913) 684-3189, AV 552-3189.

PURPOSE: The ARTBASS is a command and staff trainer designed to provide a means for a maneuver battalion commander and his staff to coordinate combat, combat support, and combat service support units under the pressures of a real-time combat environment.

DESCRIPTION:

Domain: Land and air.

Span: Accommodates any tactical area of operation and mission depending on digital map data base selected and battle scenario developed by the user.

Environment: Five digital terrain data bases with 25-meter resolution. Models day and night operations, weather conditions, roads, vegetation, rivers, built-up areas, cross-country movement, slopes, barriers, and obstacles.

Force Composition: Combined arms forces, BLUE and RED.

Scope of Conflict: Conventional warfare with virtually all Soviet and U.S. ground forces equipment and their effects modeled and controlled by the central processing unit's math equations.

Mission Area: All conventional ground warfare missions.

Level of Detail of Processes and Entities: Models personnel and equipment as comprising platoon- and company-sized units for engagement and movement. Units are attrited by decrementing personnel and equipment levels. Air units are represented as a collection of aircraft with predefined weapons suites. Operators control movement, support fire, and Admin-log functions; direct fire engagements are initiated and resolved automatically with optional operator override. Training audience does not interact with the model; operators and audience communicate using equipment intrinsic to the unit being trained. Admin-log, maintenance, and resupply are modeled explicitly, and intelligence and communication are modeled off line.

CONSTRUCTION:

Human Participation: Required for decisions and processes. The model continues to run without command decisions.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Direct fire engagements are resolved deterministically, with line-of-sight, detection, and support-fire results calculated stochastically.

Sidedness: Two-sided, symmetric, reactive simulation of engaging forces. Single operator can test, while training mode requires six operators and a cadre chief.

LIMITATIONS: ARTBASS supports a total of 200 units, 10 of which must be air units. Each unit can be involved in an arbitrary number of direct fire engagements. Supports 150 simultaneous support fire missions and 150 simultaneous obstacles including minefields. Air modeling is restricted. ARTBASS currently functions with any of five terrain areas: Fulda, Sinai, Korea, North German Plain, and Ft. Irwin.

PLANNED IMPROVEMENTS AND MODIFICATIONS: ARTBASS is currently in the Post-Deployment Software Support phase of the development cycle--model changes are made in response to a prioritized list of trouble reports and change or enhancement requests from the field.

INPUT: Equipment and ammunition characteristics, scenario unit contents and locations, and digitized terrain data. In a training exercise, inputs from a collection of peripheral devices are used to control simulation processing.

OUTPUT: Stream of event notices and summaries produced during training exercise. Map displays and unit status reports available on operator request.

HARDWARE AND SOFTWARE:

Computer:	Perkin-Elmer 3200/MPS.
Storage:	8 MB RAM with 1200 MB disk storage.
Peripherals:	Six workstations, each with at least one printer, one terminal, one high-resolution graphics screen, one bit pad, and one programmable touch keypad.
Language:	FORTRAN.
Documentation:	Extensively documented per government requirements.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Creating a terrain data base is a resource-intensive undertaking; software is provided to maintain run-time equipment and ammunition data base.

CPU time per Cycle: Approximately 30 seconds of CPU time needed to support 1 minute of simulation (depends on scenario size and training activity level).

Data Output Analysis: Model provides support for end-of-game data collection and exercise replay.

Frequency of Use: ARTBASS is supported at nine mobile field sights that are used constantly for battalion training exercises.

Users. CATA.

Comments: Managed through a configuration control board made up of representatives of CATA, CECOM MCSD, and the support contractor.

TITLE: ARTOAR - Attack Helicopter Air-to-Air Fire Control System Simulation Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Aviation Systems Command, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798.

POINT OF CONTACT: Daniel J. Breyer, (314) 263-1155, AV 693-1155.

PURPOSE: ARTOAR is used to evaluate attack helicopter fire control and turreted gun system effectiveness in one on one, nondueling air combat maneuvering engagements. The model deals with weapon systems development and effectiveness as they relate to helicopter aerial combat.

DESCRIPTION:

Domain: Air.

Span: Individual aircraft.

Environment: Flat earth, with no distinction between types of weather or time of day.

Force Composition: One firing and one target aircraft.

Scope of Conflict: Conventional guns only.

Mission Area: Air-to-air combat.

Level of Detail of Processes and Entities: Individual aircraft flight paths are represented by six degree-of-freedom trajectories. Sensors that feed target and ownship data to the fire control computer are simulated, as are the actual fire control algorithms to estimate target state, predicted impact points, and gun laying vectors. Bullet flyout is simulated by a four degree-of-freedom trajectory model, and probability of hit and kill per bullet are calculated.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Sensor readings and hit and kill calculations are stochastically based on Monte Carlo calculations.

Sidedness: Two-sided, symmetric, nonreactive.

LIMITATIONS: The model is specific to the sensors, guns, and fire control systems currently used on the AH-1S Cobra and AH-64A Apache attack helicopters. The data needed for other projectiles or advanced fire control sensors has not been developed or implemented. The aircraft flight paths are not based on helicopter or fixed-wing performance parameters, but are modeled simply as point masses.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Improve the turret mechanism model, add new technology sensors such as muzzle velocity or closed loop fire control sensors, augment the projectile and target vulnerability data bases, and use true aerodynamic qualities to simulate aircraft flight paths.

INPUT: Target and attacker flight paths, sensors and sensor accuracies, "real-world" ballistic data, physical gun characteristics, firing schedule, and fire control algorithms to be modeled.

OUTPUT: Computer printouts containing statistically analyzed probability of hit and kill data, raw data on target and ownship states, exact and measured sensor data, and plots of fire control algorithm accuracies in estimating target states.

HARDWARE AND SOFTWARE:

Computer:	IBM 4341/4381 using VM/CMS operating system.
Storage:	800 blocks (<1 MB) for the model (10,000 lines).
Peripherals:	Any computer terminal and printer can be used. Graphics are designed for a Tektronix 401x series terminal.
Language:	Model: FORTRAN 77. Graphics: PLOT 10.
Documentation:	A final report includes a user manual, an analyst manual, and methodology.

SECURITY CLASSIFICATION: Model is unclassified, and the only classified data base contains the target vulnerability data.

GENERAL DATA:
Date Implemented: June 1987.

Data Base: Generally takes one analyst one to five days to produce a data base.

CPU time per Cycle: Depending on how many Monte Carlo iterations the user decides to run, 20 seconds of combat time can take from 1 minute (1 iteration) to 10 minutes (20 iterations).

Data Output Analysis: Model provides individual, burst, and cumulative burst probabilities of hit and kill, as well as aggregate statistics over all Monte Carlo iterations.

Frequency of Use: Varies by agency, but is used at least several times per year by each user listed below.

Users: U.S. Army Aviation Systems Command; U.S. Army Armament, Research, Development and Engineering Center; and U.S. Army Aviation Applied Technology Directorate.

Comments: ARTOAR was written to develop alternative fire control algorithms for turreted guns in helicopter versus helicopter aerial combat. Other targets modeled include fixed-wing aircraft and ground targets. A new version developed by Teledyne Systems Company includes 2.75-inch flechette warhead air-to-air rockets and associated fire control, ballistic, and kill computation coding for these.

TITLE: ASESS - Air Strike/Engagement Spread Sheet

MODEL TYPE: Analysis but has been used as a exercise driver.

PROPONENT: Special Assistant for Operations Analysis, Deputy Chief of Staff, Operations, Pacific Air Forces, HQ PACAF/DOA, Hickam AFB, HI 96853-5001.

POINT OF CONTACT: Mr. Douglas Cook, (808) 449-6325, DSN (315) 449-6325,

PURPOSE: This is a attrition model that quickly examines changes in air defense force structures and effectiveness of large air strike packages.

DESCRIPTION:

Domain: Air and land, limited naval defensive operations.

Span: Accommodates any theater.

Environment: Unconstrained by distance or resources (not modeled). Effects of weather, night operations, warrior skill, technology must be incorporated into weapon system effectiveness factors.

Force Composition: BLUE and RED.

Scope of Conflict: Conventional warfare.

Mission Area: Air-to-air, offensive escort, defense suppression, airbase attack, defensive counter air, surface air defense, fleet combat air patrol, ship standoff attack, and close-in defense.

Level of Detail of Processes and Entities: Entities are aircraft, airbases, escort ships, carriers, squadrons, and carrier battle groups. Processes are squadrons of engagements that the user can turn on or off by setting a flag.

CONSTRUCTION:

Human Participation: Required if stragglers from raid group are to be chased by additional defenders.

Time Processing: Time, speed, and distance not a factor; engagements proceed in predetermined order.

Treatment of Randomness: Deterministic, expected value attrition.

Sidedness: Two sided, asymmetric, both sides reactive.

LIMITATIONS: No geography, no limit on number of expected engagements or on ordnance expended. Suitable only where combat can be separated into sequence of separate engagements. Not suitable where air-based and surface-based defenses engage the attackers at the same time.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Aircraft quantity, SAM rails, kill potential for various combinations of RED/BLUE engagements, and ship quantity. Typically, a dozen numbers are sufficient data to model an attack.

OUTPUT: Printout of spread sheet.

HARDWARE AND SOFTWARE:

Computer:	IBM PC/XT/AT compatible with MS-DOS V3.X. Also VAX 8650 with VMS 4.X.
Storage:	17 kilobytes of disk.
Peripherals:	1 dot matrix printer.
Language:	Enable V2.15, Lotus 1-2-3 (MS-DOS), 20/20 (VMS)
Documentation:	Model description (draft).

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Initial development can take up to 1 day. Changes take less than 10 minutes.

CPU time per Cycle: 1 second.

Data Output Analysis: Whatever graphics are supplied by the spreadsheet vendor.

Frequency of Use: Several times per hour during exercises/war games.

Users: HQ Pacific Air Forces/DOA, USCINCPAC/J55, Intelligence Center of the Pacific (IPAC/PT-3).

Comments: Integrated into USCINCPAC's Pacific Campaign Analysis Model (PACAMP). Modeled after spreadsheets developed by Carl Builder, Rand Corp.

TITLE: ASOAR - Achieving a System Operational Availability Requirement

MODEL TYPE: Analysis.

PROPONENT: USA CECOM, AMSEL-PL-SA, Fort Monmouth, NJ 07703-5000.

POINT OF CONTACT: Mr. Bernard Price, (201) 532 1222, AV 992 1222.

PURPOSE: ASOAR cost-effectively prorates a system operational availability requirement to end item operational availability goals. It determines the degree of supportability necessary to achieve each operational availability goal. It also determines the effective reliability and maintainability of the system and effective reliability of redundant configurations.

DESCRIPTION:

Domain: Applicable to all weapon systems.

Span: N/A.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: Weapon system operational availability and reliability analysis.

Level of Detail of Processes and Entities: End items of weapon system is the lowest entity modeled.

CONSTRUCTION:

Human Participation: Required to determine configuration of the weapon system and its forward level support concept.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Analyzes one weapon system at a time.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Development of user's manual prior to model distribution.

INPUT: System operational availability, breakout of end items, mean time to obtain line replaceable unit (LRU) spares, end item mean calendar time between failure (MCTBF), end item mean restoral time (MTR), and end item cost estimates. More inputs when the following are applicable: scheduled or preventive maintenance, multiple systems at operating level, forward sparing level not at operating level, end item commonality, hot standby redundancy, cold standby redundancy, or degradational redundancy.

OUTPUT: Whether the system design and support plan can achieve the system operational availability requirement, operational availability goals for each type of end item, operational availability goal of one end item when redundancy exists, system MCTBF, system MTR, average LRU order fill rate at forward support level to attain each operational availability goal, mean logistics down time associated to each availability goal, and effective MCTBF of each redundant configuration based on attaining the operational availability goal.

HARDWARE AND SOFTWARE:

Computer:	Zenith PC (or compatible PC) with MS-DOS 3.2 or higher.
Storage:	300 kbytes needed not including data base.
Peripherals:	Minimum requirements: monitor. Optional: printer.
Language:	FORTRAN IV.
Documentation:	Model documentation not yet available. See Comments for methodology documentation.

SECURITY CLASSIFICATION: Model without data is unclassified.

GENERAL DATA:

Date Implemented: 1989.

Data Base: Can be prepared in minutes.

CPU time per Cycle: N/A.

Data Output Analysis: Analyst quality review of output appearing on monitor or printout.

Frequency of Use: Model not yet distributed.

Users: Currently CECOM.

Comments: Methodology documentation is available: Achieving a System Operational Availability Requirement Optimally, SOLE 20th International Symposium, August 1985, and ASOAR methodology and model VuGraph Presentation, March 1989.

TITLE: ASOSM - A Sub on Sub Model

MODEL TYPE: Analysis.

PROPONENT: Naval Forces Division, Office of the Assistant Secretary of Defense (Program Analysis and Evaluation), The Pentagon, Room 2D312, Washington, DC 20301-1800.

POINT OF CONTACT: Mr. Nelson A. Jennings, (202) 695-1691, AV 225-1691.

PURPOSE: ASOSM is used to evaluate candidate submarines, sensors, and weapons in key antisubmarine mission roles.

DESCRIPTION:

Domain: Antisubmarine warfare.

Span: Designed for analysis of "one-on-one" submarine engagements.

Environment: Permits analyses based on ambient noise and propagation loss data for 20 ocean areas, summer and winter seasons, 3 receiver depths, and target depths. Long-term and short-term environmental effects are also modeled.

Force Composition: In one-on-one engagement, can model BLUE attacker versus RED defender, RED attacker versus BLUE defender, BLUE versus BLUE, etc. Can mix and match weapons and sensors in any way imaginable (e.g., a wide-aperture array on a RED sub).

Scope of Conflict: Primarily conventional warfare, but modeling nuclear weapons possible.

Mission Area: Supports analysis of following submarine missions: fixed barrier patrol, aided area search, unaided area search, transit area, and leave area.

Level of Detail of Processes and Entities: Fairly high degree of detail for submarines, sensors, and weapons. Processes are used to model submarine tactics, sensor performance, weapons use, boundary constraints, status display, and ocean noise fluctuations. Sonar equations modeled in detail.

CONSTRUCTION:

Human Participation: Required for scenario specification.

Time Processing: Event-step.

Treatment of Randomness: Starting positions of both subs are randomly arranged. Sonar detections are subject to random fluctuations. Kill assessment is stochastic.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Does not model anisotropic noise effects. Requires modification to handle many-on-many engagements.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Possibly expand mission roles modeled and permit analysis of many-on-many engagements.

INPUT: Secret data files for submarine self-noise, tactical speeds, sensor performance parameters, and weapons characteristics as well as ambient noise and propagation loss data.

OUTPUT: Graphical display of engagements as they progress, final report that summarizes model inputs (scenario) and results for all replications, and optional events summary and detections report.

HARDWARE AND SOFTWARE:

Computer:	IBM PC-XT compatible (preferably AT or 386) with DOS 2.0 or higher, math coprocessor, 640K RAM, CGA graphics (preferably EGA or VGA), and 10 MB hard disk (preferably removable due to secret data bases).
Storage:	N/A.
Peripherals:	Printer (optional).
Language:	SIMSCRIPT II.5 with SIMANIMATION. SIMSCRIPT "run-time license" required to run the model, and "compiler" version needed to make modifications to the program.
Documentation:	A Sub On Sub Model (ASOSM) Analyst's Guide.

SECURITY CLASSIFICATION: Model is unclassified, but data is classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: 20 ambient noise and 40 propagation loss data files as well as numerous secret data files on submarines, sensors, and weapons.

Program: 3000-line SIMSCRIPT program.

CPU time per Cycle: N/A.

Run Time: About 1 hour for 50 replications with graphics display, and 10 minutes without.

Data Output Analysis: Output reports providing summaries can be printed out or viewed on the screen with data editor.

Frequency of Use: Used several times per year.

Users: Naval Forces Division, OASD/PA&E.

Comments: Concept: Mr. Cheng Ling, OASD/PA&E.

Design and Development: Mr. Nelson A. Jennings and Lt. Wayne DuBose, Operations Research and Modeling Branch, 7th Communications Group/GNP. Mr. Arthur W. Pennington, Director, Naval Forces Division, OASD/PA&E, guided ASOSM's final stages of development.

TITLE: ASUMS - Aircraft Survivability with Missiles and Stealth

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. William McQuay, (513) 255-2164.

PURPOSE: ASUMS is a research and evaluation tool that serves as a capability and requirements tool for few-on-few aircraft engagements. It assesses the value of different mixes of airborne weaponry, sensors, and tactics. ASUMS may also be used as a one-on-one engagement model. In this mode, results obtained from varying the aircraft, missile, sensor, or engagement characteristics may be used to determine input to campaign models.

DESCRIPTION:

Domain: Air.

Span: Local.

Environment: None specifically modeled.

Force Composition: Few-on-few aircraft engagements.

Scope of Conflict: Conventional.

Mission Area: Aircraft engagements.

Level of Detail of Processes and Entities: ASUMS models the flight path of the aircraft and air-to-air missiles and performs sensor tracking and battle planning functions. Because many of the characteristics describing the engagement are supplied by the user, ASUMS may be used to simulate air-to-air engagements involving several aircraft using radar or electro-optical sensors. Program flexibility allows the user to specify radar and IR lock-on range against opposing aircraft, visual detection and confirmation range, delay time before launch of second missile, acceleration limits on aircraft launching missile, and missile launch logic. ASUMS executes events from an event calendar. There are three basic types of events: real world-update events, which carry out the engagement functions such as sensor tracking, battle planning, etc., and exogenous events, which are to be managed or controlled by the user outside of the program.

CONSTRUCTION:

Human Participation: Required for interactive input of visual range for each type of aircraft (required) and optional for changing state vectors for each aircraft.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, direct computation.

Sidedness: Two-sided, symmetric.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Aircraft, missile, and sensor characteristics; aircraft initialization; and aircraft maneuvers.

OUTPUT: Determines which aircraft launched which missile at another aircraft and whether a kill was accomplished.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	136,480 bytes.
Peripherals:	Printer.
Language:	FORTRAN IV.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1982.

Data Base: N/A.

CPU time per Cycle: Typically 140.9 seconds.

Data Output Analysis: Manual analysis of tabular results.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: ATTACK Model

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses, Directorate for Theater Force Analyses, Fighter Division (AFCSA/SAGF), The Pentagon, Room 1D380, Washington, DC 20330-5420.

POINT OF CONTACT: Maj W. G. Aten, (202) 694-4247, AV 224-4247.

PURPOSE: The ATTACK model is a research and evaluation tool used primarily to combine information about attrition, weapon effectiveness, target acquisition, aircraft parameters, weather, etc. in order to develop a series of measures of effectiveness for a weapon system alternative.

DESCRIPTION:
Domain: Land and air.

Span: Accommodates any theater depending on the data base. Primarily used in the European Theater.

Environment: Models day and night operations with seasonal considerations and user-provided weather conditions.

Force Composition: Single- or multi-ship flight of BLUE air-to-surface aircraft (identical aircraft only) in a RED threat environment.

Scope of Conflict: Conventional warfare; air-to-surface missions.

Mission Area: Conventional fighter aircraft on air-to-surface missions (i.e., CAS, BAI, and AI).

Level of Detail of Processes and Entities: Can determine the relative effectiveness of different BLUE aircraft (one or more aircraft within a single flight) versus a given RED ground/air threat.

CONSTRUCTION:
Human Participation: Required for decisions and processes. All data input accomplished prior to each execution of the model.

Time Processing: Dynamic, time- and event-step.

Treatment of Randomness: Deterministic (no randomness).

Sidedness: One-sided.

LIMITATIONS: Does not model force packaging.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Attrition rates, sortie generations, enroute and terminal area surface-to-air and air-to-air threats, target acquisition capability, weapons effects, battle-damage ratios, aircraft-specific parameters (sortie lengths, configurations, supply, turn times, etc.), weather, sensors, RED aircraft

encounter rates, weapon effectiveness, and logistics. With the availability of cost data, the relative cost effectiveness can also be determined.

OUTPUT: Computer printouts with daily, seasonal, cost, and overall effectiveness summaries.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on any FORTRAN-capable machine.
Storage:	30-35K for each data input set; 3-10K for each output file.
Peripherals:	Terminal and printer.
Language:	FORTRAN.
Documentation:	None.

SECURITY CLASSIFICATION: Unclassified, but I/O is usually classified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Several man-days to several man-months, depending on size of effort.

CPU time per Cycle: 4-5 seconds.

Data Output Analysis: None.

Frequency of Use: Varies with user. Several times a month within SAGF.

Users: AFCSA/SAGF, TAC/XP-JSG.

Comments: The ATTACK Model is an in-house model and is not available for distribution.

TITLE: AURA - Army Unit Resiliency Analysis

MODEL TYPE: Analysis.

PROPONENT: Ballistic Research Laboratory, Vulnerability/Lethality Division, Aberdeen Proving Ground, MD 21005-5066.

POINT OF CONTACT: Tracy P. Hindman, (301) 278-6344, AV 298-6344.

PURPOSE: The AURA model is capable of providing a wide variety of information suitable for evaluating doctrine, deployment, organization, operations, training, vulnerability, lethality, and survivability.

DESCRIPTION:

Domain: Land.

Span: Local.

Environment: Models temperature, wind speed, and wind direction.

Force Composition: Unit level through battalion level and indirect fire.

Scope of Conflict: Conventional, nuclear, chemical, and combined conventional/chemical weapons, both RED and BLUE sides.

Mission Area: Indirect artillery, bombs, rockets, and missiles.

Level of Detail of Processes and Entities: Individual soldiers and equipment.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step and event-step. Progresses through events at user-specified times.

Treatment of Randomness: Deterministic; no randomness.

Sidedness: One-sided.

LIMITATIONS: No geography.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Deployment of personnel and equipment, weapon characteristics, and unit operations.

OUTPUT: Computer printouts and raw data.

HARDWARE AND SOFTWARE:

Computer: CDC, DEC, IBM, and CRAY.
Storage: 12 MB.
Peripherals: Printer.

Language: FORTRAN
Documentation: Several manuals have been written.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1980.

Data Base: 3 man-months.

CPU time per Cycle: 10-20 seconds.

Data Output Analysis: Depends upon user-specified output options.

Frequency of Use: Used daily.

Users: BRL, AMSAA, CRDEC, TRADOC, TRAC, DAI, JAYCOR.

Comments: N/A.

TITLE: Automated FIRST BATTLE: Battalion - Corps

MODEL TYPE: Training.

PROPONENT: TRAC-FLVN, Fort Leavenworth, KS 66027-5200.

POINT OF CONTACT: MAJ Frament, (913) 684 5426, AV 552 5426.

PURPOSE: This model serves as a command post exercise driver for battalion level through corps level exercises.

DESCRIPTION:

Domain: Land and air.

Span: Geographical areas occupied by battalion- through corps-sized elements. Comes equipped with Soviet and U.S. equipment libraries, which can be easily modified to include equipment from military forces worldwide.

Environment: Size of area covered depends upon the training objective of the commander. Simulation relies on map play. By increasing or decreasing the scale of the map, you can vary the resolution of the simulation with regard to terrain and vegetation.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional conflict other than strategic nuclear, corps, or lower level/ground forces only.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: Computer-assisted CPX driver for battalion- through corps-sized units. The lowest level that can be played is a squad.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo

Sidedness: Two sided.

LIMITATIONS: No graphics or terrain representation; depends on map board and unit counters; model is game turn dependent.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Information on movement and combat description, initial definition of threat and friendly units. Certain modules require interactive answers to questions in order to define the usage of various assets.

OUTPUT: Screen and printer displays of fuel and ammunition consumption, equipment losses, and casualties. Combat spot reports for engagements as well as detailed consumption figures by game turn. Summary reports on demand.

HARDWARE AND SOFTWARE:

Computer: IBM PC or compatible.
Operating System: MS DOS 2.1 or higher.

Storage: 512K.

Peripherals: Monitor and printer.

Language: Turbo Pascal.

Documentation: N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: N/A.

CPU time per Cycle: Depends on data base size.

Data Output Analysis: Postprocessor aids in analysis output, raw data and graphics displa-

Frequency c Use: Continuous.

Users: CPX driver/training device used by divisions and corps throughout Active Army, Army Reserve, and Army National Guard.

Comments. Automated First Battle is independent of any scenario. It may be used to support a CPX utilizing any scenario of the user's devising.

TITLE: AWM - Amphibious Warfare Model

MODEL TYPE: Analysis.

PROPONENT: Center for Naval Analyses, 4401 Ford Avenue, Post Office Box 16268, Alexandria, VA 22302-0268.

POINT OF CONTACT: Dr. George Akst, AV 289-2638, (703) 824-2186.

PURPOSE: AWM is a computerized model of conventional amphibious operations and is used as an analytical tool to evalute weapons, forces, and strategies. Since its inception, the model has been used to compare alternative weapon systems, force structures, and amphibious assault concepts.

DESCRIPTION:

Domain: Land and air; partial naval support.

Span: Accommodates any regional area depending on data base; several data bases completed and others underway.

Environment: Terrain accommodated, but not in great detail; trafficability and visibility are considered. Also accommodates sea and surf for ship-to-shore movement. Does not directly model weather, time of day, or roads and barriers.

Force Composition: N/A.

Scope of Conflict: Conventional warfare only.

Mission Area: All aspects of amphibious warfare, including advance force operations, cruise missile attack and defense, ship-to-shore movement, assault landing, helicopter-borne operations, ground combat between maneuver units, artillery and naval gunfire support, tactical aircraft missions, and mine warfare.

Level of Detail of Processes and Entities: Handles levels from battalions to multiple divisions, with resolution down to the individual weapon system. The model was originally designed to handle MEF-sized operations. Many of the attrition processes are modelled using Lanchester equations, although a variety of other standard attrition models are used. Events are controlled by programmed tactical decision rules.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Time-step simulation using 1-hour intervals for the first 12 hours and 6-hour intervals thereafter.

Treatment of Randomness: Deterministic.

Sidedness. Two-sided, symmetric.

LIMITATIONS: Battlefield limited to eight sectors with eight battalion areas each, and a limited number of types of weapons (e.g., nine maneuver, six

artillery, three surface-to-air missiles, and seven fixed-wing aircraft). Except for fixed wing aircraft, no forces can cross sector boundaries.

PLANNED IMPROVEMENTS AND MODIFICATIONS: More detail in artillery logistics.

INPUT: Terrain map including near-shore hydrography, orders of battle, attrition rates, fractional damage, kill probabilities, supply consumption data, landing plans, sortie rates, landing craft, and helicopter characteristics.

OUTPUT: Computer printout of casualties and surviving forces, both cumulative and for each model period; killer-victim scoreboards; and a summary table showing FLOT movement, survivors, and force ratios.

HARDWARE AND SOFTWARE:

Computer:	Designed to run a VAX computer with a VMS operating system.
Storage:	Executable image plus base totals 1,000 blocks. Source and object codes add about another 2,000 blocks. Output files vary depending on scenario.
Peripherals:	Printer.
Language:	FORTRAN 77.
Documentation:	Model Overview (AD B0358261), Programmer's Guide (AD-B035784L), Description of Data Base (AD-C017556), Input Guide.

SECURITY CLASSIFICATION: Unclassified, but detailed description of data base is Secret.

GENERAL DATA:

Date Implemented: 1978.

Data Base: Depending on detail required, data bases can take from one to six man-months.

CPU time per Cycle: Depends on scenario and type of VAX computer; average size data base on VAX 11/785 can process each model period in about 15 seconds.

Data Output Analysis: Summary tables provided.

Frequency of Use: Sporadic, from one to several times per year.

Users: CENA, PACOM, PACFLT.

Comments:

TITLE: AWSIMS - Air Warfare Simulation System

MODEL TYPE: Training and education.

PROPONENT: HQ USAFE Warrior Preparation Center (WPC), Einsiedlerhof Air Station, Einsiedlerhof, West Germany APO New York, New York 09012.

POINT OF CONTACT: Captain C. J. Schiltz, 011-631-536-6507, AV 489-6507.

PURPOSE: AWSIMS is designed to help train senior NATO commanders and their battle staffs in the execution of wartime general defense plans that emphasize joint and combined operations. The model is used for team skills development and as a nonscripted command post exercise driver.

DESCRIPTION:

Domain: Land and air, with limited naval operations.

Span: Theater.

Environment: Latitude- and longitude-based. Models day and night operations limited weather. Cultural features modeled include: rivers, sovereign boundaries, airbases, SAMs, SHORADs, ships, and other radar sites.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional warfare. Simulation can include virtually all air conventional weapons and surface-to-air weapons.

Mission Area: All air warfare conventional missions.

Level of Detail of Processes and Entities: Can issue orders to flights of aircraft. Results include single aircraft kills. Munitions and fuel consumption are modeled with high resolution.

CONSTRUCTION:

Human Participation: Required for decisions and tasking.

Time Processing: Dynamic, time-step. Progresses through the scenario at an umpire-specified ratio of exercise time to real time.

Treatment of Randomness: Air attrition stochastically based on probability of kills as compared to a uniformly generated random number. Ground damage is modeled as "down time" for the attacked unit.

Sidedness: A three-sided (RED, BLUE, and CONTROL), symmetric, reactive model.

LIMITATIONS: Limited altitude play. Six altitude bands for SAM probability of kills. Altitude differential between airborne assets determines probability of kill. No terrain modeling.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Ongoing efforts to improve real-time performance and simulation fidelity. UNIX-based model and parallelization efforts in development.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer:	Hosted on a VAX computer with VMS 5.0 operating system.
Storage:	Two MB.
Peripherals:	Minimum requirements: 4 VT100 type terminals, 2 Tektronics 4125 byte graphics terminals. Can also drive SUN and VAX2000 workstations.
Language:	RATFOR. FORTRAN, and "C."
Documentation:	Player handbook, operator handbook, and extensive on-line and developmental documentation

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: N/A.

CPU time per Cycle: Depends on data base size and player configuration.

Data Output Analysis: Performed off-line by WPC Analysis Division using normal simulation outputs.

Frequency of Use: Up to 16 times a year depending on the WPC's exercise schedule.

Users: All NATO military commands.

Comments: AWSIMS has a two-way automated link to the WPC's ground model (GRWSIMS) to simulate the air/land battle. Air-to ground combat and ground damage are passed to GRWSIMS, and position and status data are passed back. The AWSIMS model is also linked to the WPC's communications simulation. Normal game outputs are passed to the communications suite for "real-world" report formatting and distribution.

TITLE: Balboa - Aerospace Employment Exercise

MODEL TYPE: Training and education.

PROPONENT: Squadron Officer School, Air University.

POINT OF CONTACT: Squadron Office School/EDCD (Capt Allen), Maxwell AFB, AL 36115-5582, AV 875-2730.

PURPOSE: The purpose of Balboa is to drive a student exercise that trains and educates U.S. Air Force captains on how United States air forces are employed and that illustrates each officer's unique contribution to U.S. warfighting capabilities. It also exercises group management, leadership, and communication skills in a decision-making environment under the constraints of limited time, resources, and information. Student sections of 12 to 13 members control air operations by simulating the airborne elements of the tactical air control system, specifically ABCCC and AWACS.

DESCRIPTION:

Domain: Primarily aerospace with supporting ground functions. Land force employment is scripted.

Span: Regional. Includes Panama and the northern parts of Columbia and Venezuela.

Environment: Includes details found on joint operations graphic charts 1;250,000, although most found on 1:500,000 (TPC charts).

Force Composition: Air Force tactical elements and Army air defense artillery controlled by the Tactical Air Control System; other joint operations are scripted.

Scope of Conflict: Regional, low-intensity conventional conflict; planning that includes rear area support.

Mission Area: Includes primary and specialized missions of tactical forces: counter air, interdiction, close air support, airlift, reconnaissance, and special operations.

Level of Detail of Processes and Entities: Individual aircraft sorties are divided by air-to-air or air-to-ground events. Air-to-air gaming accounts for comparative weapons capability, armament used, and intercept accuracy. Air-to-ground results determined by category of munitions used (smart, cluster, standard gravity), target hardness, and suppression of enemy air defenses.

CONSTRUCTION:

Human Participation: BLUE side requires participation for both decisions and processes. Faculty members are required to conduct adjudication and may provide some RED force response. However, RED side is primarily scripted.

Time Processing: Dynamic, time-step, real-time events with (usually) 4-minute updates.

Treatment of Randomness: Monte Carlo, based on weapon and armament, combined with ground target or enemy aircraft.

Sidedness: Two-sided with generally nonreactive RED side. Faculty members provide limited RED flexibility.

LIMITATIONS. Manual gaming is not capable of accounting for logistics limitations. Nonreactive RED play does not exploit BLUE errors in planning. Force structures are static based on operation plan deployments.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The Air Force Wargaming Center (AFWC), Maxwell AFB, has developed a computer adjudication system based on the Z-158 computer using the SMART DATA MANAGER SYSTEM by Innovative Software. This system performs Monte Carlo gaming based on a wider range of target and aircraft variables. However, it is not in use at the Squadron Officer School. AFWC is programming an advanced version that will add logistics tracking capability and deterministic RED force reaction. It will present the air order of battle on the terminal and replace the videotaped script with computer-generated outputs.

INPUT: Student-developed air tasking order and reactions to immediate requests.

OUTPUT: Mission results limited to success, partial success, failure, or loss. Photographic results based on level of sucess. Successful enemy sorties limit capabilities.

HARDWARE AND SOFTWARE:
- Computer: N/A.
- Storage: N/A.
- Peripherals: N/A.
- Language: N/A.
- Documentation: N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1989 (present version).

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: Six times per year.

Users: Squadron Officer School only.

Comments: N/A.

TITLE: BALFRAM - Balanced Force Requirements Analysis Methodology

MODEL TYPE: Analysis.

PROPONENT: USCINCPAC Staff (J55), Box 15, Camp H. M. Smith, HI 96861-5025.

POINT OF CONTACT: Mr. Karl Eulenstein, (808) 477-0885, AV (315) 477-0885.

PURPOSE: BALFRAM is a research and evaluation tool used to simulate joint warfare. Because BALFRAM is a highly flexible model, applications are largely user-designed, allowing it to deal with weapon systems effectiveness, force capability and requirements, and combat development issues.

DESCRIPTION: It provides 10 mathematical formulations of attrition plus Lanchester square, linear, and mixed differential equations with variable coefficients. The user sets the size of the time steps. The model is abstract enough that virtually all environments and types of conflict can be accommodated through user definition.

Domain: Air, land, sea, and combined.

Span: Local, regional, theater, or global (user-defined).

Environment: Not explicitly considered. The user must integrate all environmental factors into the mathematical formulations or data.

Force Composition: All types.

Scope of Conflict: Conventional, nuclear, biological, chemical, or any combination of these.

Mission Area: User-defined.

Level of Detail of Processes and Entities: User defined.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Either basically deterministic or stochastic (Monte Carlo); it is user-selectable.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Fixed numbers of battle units and battle nodes, which can be changed by source code modifications.

PLANNED IMPROVEMENTS/MODIFICATIONS: Model is being revised to decrease size, increase run speed, simplify output, add graphics, and improve overall efficiency.

INPUT: Scenario geography, network structure, interacting entities, relative effectiveness coefficients, contingency logic, movement rates and logic, selection of mathematical attrition formulas, output, time step, and

functional relationship between unit/force effectiveness and logistics availability.

OUTPUT: Battle history printouts in user-selectable level of detail and frequency; sensitivity analysis matrices in deterministic and stochastic form; statistics such as means, variances, and confidence intervals.

HARDWARE AND SOFTWARE:

Computer:	Runs on any MS-DOS, VAX, or WWMCCS Honeywell system.
Storage:	No less than 256 Kbytes.
Peripherals:	Interactive terminal and wide-carriage printer.
Language:	FORTRAN IV (being revised to FORTRAN 77).
Documentation:	Honeywell maintenance manual, user manual, and a somewhat simplistic and dated tutorial guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1976.

Data Base: User-supplied; typically takes one to two man-months to prepare.

CPU Time per Cycle: Depends on machine and simulation size; on the order of minutes for a theater-level, deterministic simulation of a single region, run on a Compaq 386/16. For stochastic runs, multiply the deterministic run time by the number of iterations.

Data Output Analysis: Minutes.

Frequency of Use: Not in use while being revised. In its heyday, it was used about twice per year.

Users: USCINCPAC.

Comments: Because extensive revisions are underway, model will not be available until late 1989 at the earliest.

TITLE: BBS (COMBAT-SIM)

MODEL TYPE: Training.

PROPONENT: TRAC-FLVN, Fort Leavenworth, KS 66027-5200.

POINT OF CONTACT: CPT Stover, (913) 684 2859, AV 552 2859.

PURPOSE: BBS (COMBAT-SIM) is designed to provide battalions, brigades, their commanders, and their commanders' staffs an environment in which to train in the execution of airland battle doctrine at the tactical level of war.

DESCRIPTION:

Domain: Land and air.

Span: Accommodates any theater depending on the data base. Scenarios of Europe, Korea, Sinai, and NTC are available.

Environment: Digitized, hex-based. Models deserts, mountains, forests, and jungles. Models weather conditions, including visibility, cloud cover, and precipitation.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional.

Mission Area: All conventional missions except unconventional warfare.

Level of Detail of Processes and Entities: Individual weapon system.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-step model.

Treatment of Randomness: Stochastic.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Limited to play terrain types available as digitized data with video disk display.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Movement and conflict order, unit names and locations, resupply.

OUTPUT: Conflict resolution, battle damage, personnel and logistics losses, alerts, reports, and graphic battle depiction.

HARDWARE AND SOFTWARE:

Computer: Designed to run on DEC computer with a VMS operating system.
Storage: Minimum storage required: 71 MB.

Peripherals: Terminals, printers, TV, IEV graphics processor, and mouse. Color Graphics: IEV-60 graphics coprocessor.
Language: MODULA-2.
Documentation: N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1988.

Data Base: N/A.

CPU time per Cycle: Depends on the size of the data base and the number of players.

Data Output Analysis: Postprocessor aids in analysis output, raw data, graphics display, and time periods.

Frequency of Use: Continuous.

Users: Currently being fielded.

Comments: N/A.

TITLE: BEST WEAPON

MODEL TYPE: Analysis.

PROPONENT: AD/XRP, Directorate of Plans and Integration, Elgin AFB, FL 32542-5000.

POINT OF CONTACT: Mr. Martel or Ms. Willis, (904) 882-4151.

PURPOSE: The purpose of the BEST WEAPON computer model and data base system is to provide analysis in support of the Armament Division Non-nuclear Armament Plan and the HQ AFSC Armament Mission Area Plan. The BEST WEAPON model and data base system assesses inventory, developmental, and conceptual non-nuclear munitions as part of total weapon system concepts.

DESCRIPTION:

Domain: Land and air.

Span: Theater.

Environment: Day, night, and weather; three theaters; and three time frames.

Force Composition: For each theater: 20 aircraft types, 58 weapons, 85 targets, and 60 avionic types (SAR, LANTIRN, etc.).

Scope of Conflict: Conventional, theater (no chemical warfare).

Mission Area: Defensive counterair, offensive counterair, lethal suppression of enemy air defense, air-to-surface fixed, and air-to-surface nonfixed.

Level of Detail of Processes and Entities: Entities: Single weapon, single aircraft, and single avionics package going against a single target. Processes: Calculates aircraft remaining, targets killed, and weapons expended using attrition and effectiveness data for each aircraft, weapon, avionic, and target combination.

CONSTRUCTION:

Human Participation: Required for data base preparation and initial case variables input. These variables are theater, year, mission area, mobility option, threat, and weapon candidates.

Time Processing: Dynamic, time-step model.

Treatment of Randomness: Deterministic, value generated as a function of expected value.

Sidedness: N/A.

LIMITATIONS: 20 aircraft, 58 weapons, 60 avionic, and 85 targets.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Data base management, air-to-air methodology, increase aircraft and weapon capability, target acquisition methodology, and capability to analyze mines.

INPUT: Aircraft, sortie rates, attrition drawdown, mission capability rates, weather frequency, payloads, number of passes, single pass expected kills, attrition, target acquisition, targets, and target/sortie allocation.

OUTPUT: Targets killed, aircraft remaining, and weapons expended.

HARDWARE AND SOFTWARE:

Computer:	VAX.
Storage:	2,000 storage blocks for programs and 50,000 storage blocks for data.
Peripherals:	Printer.
Language:	FORTRAN 77.
Documentation:	Fully documented.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: 1 day to 6 months.

CPU Time per Cycle: Varies depending on mission area.

Data Output Analysis: Ongoing.

Frequency of Use: Weekly.

Users: AD/XRP, Directorate of Plans and Integration.

Comments: None.

TITLE: BETA

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. Bill McQuay, (513) 255-2164.

PURPOSE: BETA computes the probability that a missile with a blast-fragmentation warhead will kill an aircraft target. The program determines whether a missile flying by an aircraft will fuze its warhead, and then calculates the effects of projectiles from the warhead blast on the target.

DESCRIPTION:

Domain: Land, sea, or air.

Span: Individual.

Environment: N/A.

Force Composition: One missile and one aircraft.

Scope of Conflict: Conventional.

Mission Area: N/A.

Level of Detail of Processes and Entities: The user inputs the details of the missile and aircraft descriptions and the geometry of their engagement; BETA contains no previously defined missiles or aircraft. The program assumes that the missile is in the terminal phase of its flight, which means that the missile can no longer make any change in its flight path as a result of information received by its guidance systems. Constant velocity vectors are assumed for both the target aircraft and the missile throughout the engagement. The pKs are generated according the mode chosen. (Modes are explained in the Treatment of Randomness section.)

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic.

Treatment of Randomness: Three modes of trajectory generation are available to the user. In the random or Monte Carlo mode, the user takes guidance system errors into account by calculating kill probabilities for many parallel or randomly distributed trajectories. In the parametric mode, the model generates many parallel missile trajectories uniformly distributed at a specified radial miss distance or in an elliptical distribution. The radial miss distance can be incremented. The program output in this mode can be used to plot curves of single-shot kill probability as a function of circular error probability and pK versus mile distance. In the single-shot mode, components of miss distance are specified for each missile trajectory. This mode is suitable for simulator studies, i.e., calculating kill probabilities associated with individual missile trajectories.

Sidedness: Two sided, nonreactive.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Threat characteristics: warhead, fuze. Target: fuselage, blast contour, component vulnerable areas, target points. Case: Air density, critical fragment, ricochet angle, minimum effective fragment velocity, trajectory, pK cutoff values. Engagement conditions: altitude, target, missile.

OUTPUT: Includes the input variables, the number of blast kills, the pK tables for each of the components, and the total pK for the aircraft. There are pK tables for each of the trajectories and detonation points and a pK table for the average over the different detonation point cases.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	272,865 bytes.
Peripherals:	No special requirements.
Language:	FORTRAN IV.
Documentation:	User's guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1981.

Data Base: N/A.

CPU time per Cycle: Six seconds for a simple single trajectory and detonation run.

Data Output Analysis: N/A (no postprocessor).

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: Big Stick

MODEL TYPE: Training and education.

PROPONENT: Air Force Wargaming Center (AFWC), Maxwell AFB, AL 36112.

POINT OF CONTACT: Col. T. Yax, AUCADRE/WGO, Maxwell AFB, AL 36112, (205) 293 6618, AV 875 6618.

PURPOSE: Big Stick, a seminar exercise driver, addresses the general concepts used in the planning, development, deployment, and employment of nuclear forces. It is a planning exercise and war simulation designed to test opposing plans of nuclear forces design straategy. Each side develops and executes a military strategy (force deployment and employment) to meet objectives derived from the National Command Authority guidance and constraints such as budget and arms agreements and treaties.

DESCRIPTION:

Domain: N/A.

Span: United States, Europe, and the Soviet Union.

Environment: Day, night, and weather effects.

Force Composition: Strategic nuclear forces.

Scope of Conflict: Strategic.

Mission Area: CONUS, Central Europe, and the Soviet Union.

Level of Detail of Processes and Entities: Individual weapons system.

CONSTRUCTION:

Human Participation: Required for process and analysis.

Time Processing: Inputs must meet real-time restrictions, but game play is event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two sided, with BLUE and RED teams.

LIMITATIONS: Aircraft recovering to South America are lost to game play.

PLANNED IMPROVEMENTS AND MODIFICATIONS: A CYBER version is under development. The projected date of completion is late 1988 or early 1989.

INPUT: Players select forces within budget and treaty limitations, deploy forces, and target and employ force according to the exercise plan.

OUTPUT: Big Stick summarizes player force selection, deployed forces, execution options, and offensive and defensive positions at the end of each time period. Big Stick also provides a work sheet to allow targeting by tail number to ease game play. At the end of the game Big Stick gives a summary of surviving assets.

HARDWARE AND SOFTWARE:

Computer (OS): Honeywell 6000.
Storage: 8569 blocks of 320 words each.
Peripherals: Terminal and printer.
Language: FORTRAN.
Documentation: User and maintenance manuals available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: Honeywell version: 1980
CYBER version: (Under development)

Data Base: About two man months needed to rebuild data base.

CPU time per Cycle: Determined by user.

Data Output Analysis: Big Stick includes a monitor program to recover errors by both the system and the user.

Frequency of Use: Once per class at Air Command and Staff College (ACSC).

Users: ACSC.

Comments: Managed through the review and configuration control board at the AFWC.

TITLE: BLDM - Battalion Level Differential Model

MODEL TYPE: Analysis.

PROPONENT: Vector Research, Incorporated (VRI), P.O. Box 1506, Ann Arbor, Michigan 48106.

POINT OF CONTACT: Stanley L. Spaulding, (313) 973 9210.

PURPOSE: BLDM is a research and evaluation tool used in systems effectiveness and weapons mix studies.

DESCRIPTION:
Domain: Land.

Span: BLUE company- to battalion sized forces engaging RED regimental-sized forces.

Environment: Digitized terrain for representation of cover and concealment. Some limited treatment of conditions such as day/night and smoke.

Force Composition: Combined arms forces including armored vehicles, dismounted antitank weapons, attack and scout helicopters, and artillery (the latter as firers but not as targets).

Scope of Conflict: Conventional weapons, including smart munitions.

Mission Area: Direct fire engagements with indirect fire support.

Level of Detail of Processes and Entities: Entities are represented as groups of systems, each consisting of one or more collocated weapon of a single type. Process models that determine acquisition and attrition of and by opposing groups consider physically measurable characteristics of the weapons such as pinpoint acquisition probabilities, nonpinpoint acquisition rates, firing times, dispersions and biases, round reliabilities, and probabilities of kill given a hit.

CONSTRUCTION:
Human Participation: Not required. Some scheduled changes are permitted.

Time Processing: Dynamic, time-step model.

Treatment of Randomness: Deterministic, employs differential equations to approximate expected attrition over time.

Sidedness: Two-sided, symmetric.

LIMITATIONS: No fixed wing tactical air. All movement is preplanned.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Minor improvements are frequently made to support specific study needs.

INPUT: Initial number of weapons by type and location, movement over time, cover and concealment, round and target choice criteria, target acquisition data, and weapon performance data.

OUTPUT: Engagement history including numbers of survivors, killer victim scoreboards, and cumulative rounds fired by type, all as a function of time into the engagement. Summary statistics based on these detailed outputs such as force ratios and loss exchange ratios.

HARDWARE AND SOFTWARE:

Computer:	Not dependent on any particular hardware or operating system. Has run on a number of mainframe and minicomputers.
Storage:	680,000 bytes.
Peripherals:	No special peripherals are required.
Language:	FORTRAN 66.
Documentation:	Users manual describes original model. Limited documentation exists for significant enhancements made to original model.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1975.

Data Base: Two or three person days to incorporate extensive modifications into and existing performance data base. Several person-weeks to develop an entire new scenario and performance data base.

CPU time per Cycle: Approximately 10 seconds per simulated engagement on an IBM 3090 mainframe.

Data Output Analysis: A few hours to a few days are required for analysis of a set of parametric runs.

Frequency of Use: Two or three studies per year.

Users: Current active user is VRI.

Comments: BLDM is one of many variants of the differential models of combat developed by VRI. Models in this family have included the Bonder/IUA model, AIDM (AMSAA Improved Differential Model), and many others. A more aggregate version of the model is used to assess the results of direct fire engagements in a number of division through theater level models, including the Army's corps level model VIC. Users of the BLDM family of models have included Weapon Systems Analysis Directorate, AMSAA, TRAC WSMR, CACDA, Weapons Command, the Marine Corps, a variety of other government agencies, and several industrial users.

TITLE: BLOCKBUSTER

MODEL TYPE. Training and education.

PROPONENT: Office of the Training Simulations System Manager (TSSM), The Combined Arms Training Activity (CATA), Ft. Leavenworth, KS 66027-7000.

POINT OF CONTACT: CPT John Hughes or SFC Albert J. Malveaux, AV 552-3395/3189.

PURPOSE: BLOCKBUSTER is designed to train company commanders and staffs in staff procedures while operating in urban areas.

DESCRIPTION:

Domain: Land (urban).

Span: Primarily designed for company commanders.

Environment: BLOCKBUSTER is an independently based simulation that can handle day or night operations in all weather conditions.

Force Composition: Company and limited battalion assets.

Scope of Conflict: Conventional urban warfare.

Mission Area: Any urban terrain.

Level of Detail of Processes and Entities: Can process down to team level.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time step.

Treatment of Randomness: Uses randomly generated tables for combat resolution.

Sidedness: Two sided, asymmetric.

LIMITATIONS: Limited to company play in urban terrain.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer: None.
Storage: None.
Peripherals: None.
Language: None.
Documentation: None.

SECURITY CLASSIFICATION: None.

GENERAL DATA:

Date Implemented: 1984.

Data Base: None.

CPU time per Cycle: None.

Data Output Analysis: None.

Frequency of Use. BLOCKBUSTER is no longer a primary simulation; it will be replaced by automated simulations in approximately 1992.

Users: Schools, Ft. Hood. Berlin Brigade.

Comments: N/A.

TITLE: BLUEMAX II (Flight Path Generator)

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SAFGF), The Pentagon, Washington, DC 20330-5420.

POINT OF CONTACT: Maj R. J. Lutz, (202) 694-4247, AV 224-4247.

PURPOSE: BLUEMAX II is an aircraft flight path generator for use in weapon systems effectiveness studies.

DESCRIPTION:

Domain: Air.

Span: Individual.

Environment: Terrain relief.

Force Composition: Element.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Single aircraft. Movement of aircraft.

CONSTRUCTION:

Human Participation: Required.

Time Processing: Dynamic, closed form.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: This is a five degree of freedom model (sideslip is not included).

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Interactive input requirements depend on the type of maneuver desired and are requested by the computer when an appropriate maneuver is designated. Inputs include initial aircraft altitude, airspeed, heading, pitch, weight, and drag. Further inputs will be required for changes in pitch heading, "G," power constraints, and time for maneuver. Batch inputs include a "control file" that specifies the desired square of maneuvers and the parameters for each. Aircraft aerodynamic and propulsion data are contained in a data base. Digital terrain data are required for flight over terrain.

OUTPUT: Computer printout listing aircraft position data, speed heading, pitch, roll, "G," throttle setting, and AOA.

HARDWARE AND SOFTWARE:

Computer:	IBM 3081 (MVS), VAX 11/780 PC-compatible (MS-DOS)
Storage:	N/A.
Peripherals:	N/A.
Language:	FORTRAN 77
Documentation:	Available from SURVIAC (Model Repository), Wright-Patterson AFB.

SECURITY CLASSIFICATION: Unclassified (without input data)

GENERAL DATA:

Date Implemented: 1982 - 1983.

Data Base: N/A.

CPU time per Cycle: 30 minutes.

Data Output Analysis: N/A.

Frequency of Use: 3 to 5 times per month.

Users: AFCSA/SAGF, AFWAL/FIAA, AFOTEC/OA, others.

Comments: Output can be used by TAPM, ESAMS, TAC REPELLER, and POO1 models.

TITLE: BODESIM - Barrier/Obstacle Deployment and Effectiveness Simulation Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Engineer Waterways Experiment Station, ATTN: CEWES-EN-A, P.O. Box 631, Vicksburg, MS 39181-0631.

POINT OF CONTACT: Phillip L. Doiron, (601) 634-3855.

PURPOSE: BODESIM is used primarily to analyze the deployment and effectiveness of countermobility obstacles in realistic terrain and environmental conditions. The model can simulate the deployment and effectiveness of U.S. obstacle systems and will have the capability in the near future to simulate the deployment and effectiveness of foreign obstacle mine systems. BODESIM can be used to produce tactical decision aides for a battlefield commander.

DESCRIPTION:

Domain: Land.

Span: Based on 1:50,000 scale map quadrangle.

Environment: Grid-based. Each 100m grid cell contains the terrain and environmental descriptions of the area. These terrain descriptions can include the topographic elevation; vegetation type, height, and density; soil type and moisture content; water depth, width, and velocity; urban structure height and density; and road type and width. The environmental descriptions can include the type and amount of precipitation and the snow depth.

Force Composition: Obstacle system assets, both BLUE and RED.

Scope of Conflict: Conventional and unconventional.

Mission Area: Countermobility operations.

Level of Detail of Processes and Entities: Simulate the performance of each individual obstacle emplacement system. The simulation is geared primarily to analyze the interactions of the obstacle systems with the terrain and environmental conditions occurring in the selected minefield areas. The obstacles can be located anywhere on a 1:50,000 scale map quadrangle and can be of any size and configuration.

CONSTRUCTION:

Human Participation: Required to select the obstacle system parameters.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, symmetric.

LIMITATIONS: None.

PLANNED IMPROVEMENTS AND MODIFICATIONS: In the near future, foreign obstacle emplacement systems will be included. BODESIM will be implemented on an MS DOS-based PC.

INPUT: Relevant terrain and environmental factors and obstacle emplacement system characteristics.

OUTPUT: Produces graphical display and tabular printouts of obstacle emplacement and effectiveness performance.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a MicroVAX computer with VMS operating system.
Storage:	4.5 MB required to run the model.
Peripherals:	Minimum requirements: 1 printer, 1 Raster 380 graphics terminal, 1 VT100 terminal.
Language:	FORTRAN.
Documentation:	Model description report (in preparation).

SECURITY CLASSIFICATION: Model is unclassified, but some data and model outputs are classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: 3 months to prepare digital terrain data base.

CPU time per Cycle: 27.33 seconds.

Data Output Analysis: Manual.

Frequency of Use: Used when required to support research and development efforts.

Users: U.S. Army Engineer Waterways Experiment Station.

Comments: Model has been activated on the AirLand and Battlefield Environment Test-Bed System.

TITLE: BONeS - Block Oriented Network Simulator

MODEL TYPE: Analysis (can also be used as training model).

PROPONENT: Comdisco Systems, Inc., 600 Lawrence Ave., Suite 2B, Lawrence, KS 66049.

POINT OF CONTACT: William LaRue, (913) 841-1283.

PURPOSE: BONeS is used primarily as a research and evaluation tool that provides an integrated, interactive, and graphical environment for simulation-based analysis and the design of communication networks. BONeS minimizes the amount of simulation code that a network engineer has to develop. Programming is replaced by graphical definition of the network topology and protocol functions that are translated by BONeS into simulation code. BONeS also provides on-line help and error checking, as well as management of data bases that contain simulation models and results. These features permit the network engineer to concentrate on problem definition and analysis rather than on the mechanics and mundane details of the simulation.

DESCRIPTION:

Domain: BONeS models all computer communication networks.

Span: Global.

Environment: Hierarchical.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: Command and control communications.

Level of Detail of Processes and Entities: The Post Processor analyzes and displays the results of a simulation. It allows the user to specify a conditional that selects the exact data from a probe file that is of interest and rejects the rest of the data.

CONSTRUCTION:

Human Participation: Required for model development and specification.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: Limited to determining network performance. Does not verify protocol correctness.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Expanded module library, animation, and topology editor.

INPUT: Graphically specified network topology, data structures, and protocol functions are entered through a mouse-based window system.

OUTPUT: Simulation results (delays, throughput, buffer occupancy, etc.) from the post processor are displayed and are available as printouts or graphs.

HARDWARE AND SOFTWARE:

Computer:	Sun 3 or Sun 4 under Sun/OS 4.0.
Storage:	8 MB RAM, 1/4-inch, 60 MB cassette, 141 MB hard disk.
Peripherals:	Minimum requirement: Postscript printer.
Language:	LISP and "C."
Documentation:	Programmer's manual and user's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1989.

Data Base: One hour to several months required to develop model.

CPU time per Cycle: Dependent on data base size; large networks can take hours.

Data Output Analysis: Less than 30 seconds for typical problem.

Frequency of Use: Not yet determined.

Users: Comdisco Systems, Inc., Air Force Systems Command (AFSC).

Comments: The BONeS product will be commercially available December 1989. BONeS is the result of an AFSC Small Business Innovative Research effort under RADC Contract F30602-87-C0013.

TITLE: Bottom Line

MODEL TYPE: Training and education.

PROPONENT: Air Force Wargaming Center (AFWC), Maxwell AFB, AL 36112.

POINT OF CONTACT: Col. T. Yax, AUCADRE/WGO, Maxwell AFB, AL 36112, (205) 293-6618, AV 875-6618.

PURPOSE: Bottom Line, a seminar exercise driver, is a budget impact analysis program. It is a role-playing game designed to promote student understanding of the executive-level decision-making process, the relationships involved in the allocation of limited national resources, and the subsequent impact on the state of the nation.

DESCRIPTION:

Domain: President, cabinet, and budget advisors.

Span: Simulates the four years of a presidential term.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Cabinet level of detail with 17 areas of budget manipulation. Areas include both receipts and expenditures.

CONSTRUCTION:

Human Participation: Required for budgetary decisions and resource allocations.

Time Processing: Students must complete all four game years within three hours. Bottom Line maintains the game clock.

Treatment of Randomness: Bottom Line is deterministic except for the probability of conventional war. Its algorithms, based on current economic theory, include Okun's Law and the Phillip's Curve.

Sidedness: Single-sided with each team attempting to maximize its end-game points. Many teams may participate with the end score being manually compared to determine an overall result.

LIMITATIONS: This game does not accurately account for econometric anomalies of the Phillip's Curve.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Bottom Line simulates four years of play. At the beginning of each year, players enter political and economic decisions concerning national receipts (U.S. foreign aggressiveness, individual and corporate income taxes,

social insurance, excise taxes, estate and gift taxes, and miscellaneous receipts) and national expenditures (national defense, international affairs, space and technology, health and welfare, community development, veteran's benefits, agriculture, commerce and transportation, education and training, and general government).

OUTPUT: Bottom Line calculates and reports the impact of the decisions on the national economy. The player can then "what-if" the political-economic decisions until he attains acceptable results. At the end of the fourth year the player should satisfy the following parameters:

a. Reelection in 1988.
b. Probability of nuclear war below 7%.
c. Unemployment at or below 4.9% (full employment).
d. Achieve real GNP growth of 3% per year.
e. Internal Unrest Index below 5.5.
f. Inflation below 4% per year.
g. Discomfort Index below 10.
h. Limited War Trend Index 0 or above 40.
i. U.S. World Influence Index 5.25.
j. Cold War Index above 5.
k. Budget deficit minimized.

HARDWARE AND SOFTWARE:
Computer (OS): IBM compatible MS-DOS machine with floppy disk drive and 256 KB RAM.
Storage: 108 KB for executable and 10 KB for archival data.
Peripherals: Monochrome monitor (color optional) and printer.
Language: MS-Pascal and MS-ASSEMBLER.
Documentation: User and maintenance manuals available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: September 1986.

Data Base: Requires one hour to update.

CPU time per Cycle: N/A.

Data Output Analysis: Produces hard copy of output data and historical archive of previous student inputs.

Frequency of Use: Used six times per year by user named below.

Users: Center for Professional Development of the Professional Military Comptroller School.

Comments: Managed throughout the review and configuration control board at the AFWC.

TITLE: BPS - Battlefield Planning System

MODEL TYPE: Training and education.

PROPONENT: U.S. Army TRADOC Analysis Command (TRAC-WSMR), White Sands Missile Range, NM 88002-5502.

POINT OF CONTACT: MAJ Bruce T. Robinson, (505) 678-3802, AV 258-3802.

PURPOSE: BPS is an automated decision aid that assists the brigade and division staffs in the planning process. It is used for skills development, primarily terrain analysis and wargaming courses of action.

DESCRIPTION:

Domain: Land and air.

Span: Regional, including portions of West Germany, Korea, Southwest Asia, Egypt, and the National Training Center.

Environment: Uses digitized terrain at 100-meter granularity. Terrain data includes elevation, land use, soil type, roads, rivers, obstacles, and vegetation height. Models the weather, employs the WES-developed mobility model, and utilizes precomputed line-of-sight probabilities.

Force Composition: BLUE and RED divisional forces.

Scope of Conflict: All conventional weapons organic to the BLUE and RED divisions.

Mission Area: Standard divisional combat mission, including attack helicopters and artillery.

Level of Detail of Processes and Entities: Entities range from individual weapons systems to brigade-sized units. Attrition, logistics, and movement are employed down to single entities.

CONSTRUCTION:

Human Participation: Required for processes.

Time Processing: Dynamic, time-step model.

Treatment of Randomness: Model can be run in two modes with attrition determined purely by Lanchestrian or stochastic means; direct computation of probability of kill and Monte Carlo determination of results.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Size of digital map and number of weapons, unit routes, and targets limited by capabilities of the computer.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Enhanced logistical simulations are planned.

INPUT: Terrain, movement, unit instructions, force composition, weapons data, and weather.

OUTPUT: Printouts of attrition and logistics data and graphs of simulation results. Also generates operation orders, operations overlays to scale, color maps, relief maps, and line-of-sight profiles.

HARDWARE AND SOFTWARE:

Computer:	Runs on Hewlett-Packard 9000 series with UNIX operating system.
Storage:	Requires 4 MB RAM, 20 MB storage.
Peripherals:	One printer (preferably color), one graphics plotter, one color monitor with 8-bit planes.
Language:	Pascal, "C," FORTRAN.
Documentation:	Minimum documentation available.

SECURITY CLASSIFICATION: Unclassified without weapons data.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Generation of new, high-quality digitized terrain can take several months (DMA). Likewise, weapons data is subject to availability from AMSA.

CPU time per Cycle: One hour of combat for brigade-sized forces requires no more than five minutes of CPU time.

Data Output Analysis: Printouts and graphs are easily interpreted by the user.

Frequency of Use: Varies by user. Used weekly by the 8th ID.

Users: 8th ID, 3rd ACR, CGSC.

Comments: BPS was developed to support the 8th ID. Model is continuously updated on their request.

TITLE: BRLFCS - Ballistic Research Laboratory Firepower Control Simulation

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Ballistic Research Laboratory, Aberdeen Proving Ground, MD 21005-5066.

POINT OF CONTACT: Alan R. Downs, (301) 278-3837, AV 298-3837.

PURPOSE: The BRLFCS model was designed to analyze conceptual and developmental information distribution systems. It is compatible with existing (TACFIRE), emerging (AFATDS), and conceptual command and control systems.

DESCRIPTION:

Domain: Land.

Span: From maneuver brigade down, including relevant fire support.

Environment: Transmission times, delays, utilizations, and queues for all units and networks in the simulation.

Force Composition: Any mix of BLUE forces, brigade, and below.

Scope of Conflict: Any conflict for which data transmission requirements can be specified.

Mission Area: No restrictions.

Level of Detail of Processes and Entities: Resolution down to individual radios and data distribution units. Operates with 260 in game; provision for 500. Results based on properties of individual transmitters and operators as well as on mission initiation forcing function and network constraints.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step. Progresses through events based on timed inputs and system-imposed constraints.

Treatment of Randomness: Stochastic treatment of mission start times; stochastic, Monte Carlo determination of message or data transmission failures.

Sidedness: One-sided.

LIMITATIONS: BRLFCS does not yet include multi-path information routes. Unit attrition is not addressed. Data for model validation is not currently available.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Provision for unusual acknowledgement procedures and multi-path data transmission (redundancy) will be added.

INPUT: Relevant network, unit, transmission, length and time, transmitter characteristics and placement, and scenario data (e.g., start and stop times) are required.

OUTPUT: Computer printouts, tables, and graphs describe patterns of unit and network loading, queues, and message and mission timelines.

HARDWARE AND SOFTWARE:

Computer:	Runs in reduced scale on a Gould 9600. Full-scale runs will be performed on a CRAY.
Storage:	5 MB required.
Peripherals:	Minimum requirements: 1 printer and 1 graphics output device.
Language:	Coded in "C."
Documentation:	User's Manual being prepared.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1989.

Data Base: About two man-months to set up a complicated analysis.

CPU time per Cycle: Depends on data base size and player configuration; heavily loaded scenario can take minutes of CPU time per event hour on the Gould; much less is expected on the CRAY.

Data Output Analysis: Remote calls to graphics output machines produce plots. Tables prepared by laser printer.

Frequency of Use: As yet unknown, but moderate use through at least 1990 is expected.

Users: U.S. Army Ballistic Research Laboratory.

Comments: To be transferred to CRAY in Fall 1988. Full-scale operation in Spring 1989.

TITLE: Buildup

MODEL TYPE: Analysis.

PROPONENT: Studies, Concepts and Analysis Division, Logistics Directorate (J-4), The Joint Staff, The Pentagon, Room 2E827, Washington, DC 20318-4000.

POINT OF CONTACT: CDR K. J. Kelley, (202) 696-6110, AV 225-9212.

PURPOSE: Buildup is an intratheater simulation model that sequentially processes movement requirements through a transportation network representing a specific area. Buildup has been used to model both CONUS and Warsaw Pact intratheater movement in the European Theatre of Operations.

DESCRIPTION:

Domain: Land.

Span: Can accommodate any theater including limited sea movement.

Environment: Network-based rail and road movement including nodes, depots, and associated capacities for rail and vehicle movement.

Force Composition: Various military land transportable units up to and including divisions, squadrons, and various support units.

Scope of Conflict: Conventional, although conflict is not modeled.

Mission Area: Intratheater mobility.

Level of Detail of Processes and Entities: Individual vehicles and rolling stock are loaded by capacity. Onload , offload, and transfer times and speeds for each vehicle class are modeled. Each link has a mode, length, and capacity in vehicles per unit time.

CONSTRUCTION:

Human Participation: Limited to preparation of data base and analysis of output.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic.

Sidedness: N/A.

LIMITATIONS: No attrition of material, and packages (cargo) are delayed at their origin to avoid delays en route. The order in which the packages are presented to the model affects the solution. The following limits, although not a program constraint, are typical of problems run: 200 simulation days (time periods), 8000 links, 5000 packages.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Three input files are required for a Buildup solution. The scenario file includes the vehicle characteristics, number of days being simulated, and

aircraft utilization rates. The network file includes links, nodes, and capacities. The requirements package file contains data on each package, such as origin, destination, availability, and vehicle requirements. A fourth optional file may be used to vary link capacities and vehicle availability.

OUTPUT: Buildup produces two output files that can be viewed at the terminal or printed in hard copy. The solution file provides a summary report of link status and daily vehicle usage. The movement file provides data for each package including destination, links used, and a record of when the package entered each node. This data is used by a postprocessor to produce a time-phased profile of the arrival of units at their ultimate destination.

HARDWARE AND SOFTWARE:

Computer:	VAX/MULTICS
Storage:	Varies with the size of the data base and network.
Peripherals:	Computer terminal and printer.
Language:	FORTRAN.
Documentation:	Buildup User's Manual (published by General Research Corporation).

SECURITY CLASSIFICATION: Unclassified (without data).

GENERAL DATA:

Date Implemented: 1976.

Data Base: Ten man-hours to set up an average data base.

CPU time per Cycle: 30 minutes per model cycle.

Data Output Analysis: Between 1 and 10 man-days to analyze results.

Frequency of Use: No longer used for logistic simulation by DOD activities.

Users: DIA, OASD (PA&E), JDSSC, JCS (J-4)

Comments: Model supplanted by more state-of-the-art simulations.

TITLE: CAMMS - Condensed Army Mobility Model System

MODEL TYPE: Analysis (primarily as a tactical decision aid, but also useful in training and education as an exercise driver and training model).

PROPONENT: Mobility Systems Division, Geotechnical Laboratory, U.S. Army Engineer Waterways Experiment Station, P.O. Box 631 Vicksburg, MS 39181-0631.

POINT OF CONTACT: Mr. Newell Murphy, (601) 634-2447; Mr. Donald Randolph, (601) 634-2694.

PURPOSE: CAMMS describes vehicle and foot soldier mobility on- and off-road and was developed primarily to provide tactical decision aids for U.S. Army operations at corps level and below. It can also be used to assess vehicle force mobility capabilities and as an exercise driver.

DESCRIPTION:

Domain: On road, off road (forests, farmlands, etc.), across gaps.

Span: Useful from individual vehicle or soldier level up to corps level.

Environment: Off-road area terrain ordinarily in raster, roads and linear features in vector, and urban areas in raster or vector. Each terrain type described by all factors that significantly influence mobility (e.g., slope, surface, vegetation, visibility, obstacles). The overall terrain description can be developed from TTADB, ITD, or similar terrain data bases developed by DMA. Models weather effects on historical, near-real-time, and forecast bases; can model day and night mobility.

Force Composition: Joint and combined forces, RED and BLUE.

Scope of Conflict: Can adjust vehicle mobility relative to battlefield damage and set rules for restricting or eliminating mobility as function of conventional, unconventional, or nuclear warfare.

Mission Area: All missions involving U.S. military ground vehicle mobility.

Level of Detail of Processes and Entities: Lowest entity is single vehicle or soldier, up to columns and units of vehicles or soldiers. Processes are primarily deterministic based on field-validated relations. Monte Carlo procedures interpret terrain and historical weather data. Mobility on road, off road, and across gaps is modeled in a modular software format that compares pertinent vehicle and driver or soldier capabilities with those necessary to satisfy specified terrain, weather, mission requirements. Outputs can be used to evaluate avenues of approach, gap crossing sites, vehicle optimum mix, and cross-country routes.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, event-step model.

Treatment of Randomness: Mobility treated in deterministic fashion, terrain and historical weather by measured data, then limited Monte Carlo procedures.

Sidedness: Two-sided, symmetric. Single operator or multiple operators.

LIMITATIONS: Limited capability to model mobility in snow, engineer-assisted gap crossing, avenues of approach, military-emplaced obstacles, cover and concealment, formation movement, and urban mobility.

PLANNED IMPROVEMENTS AND MODIFICATIONS: In process of removing limitations.

INPUT: Prescribed digitized data describes vehicle, driver, terrain, weather and scenario factors that have a significant effect on ground vehicle and soldier mobility for specified mission requirements.

OUTPUT: Computer screen and hard-copy maps, overlays, and tabulations suitable for mobility tactical decision aids.

HARDWARE AND SOFTWARE:

Computer:	PC version designed to run on IBM PC-compatible with MS DOS operating system; VAX version on VAX computers with VMS operating system.
Storage:	Before data base installed: PC version 4 MB; VAX version 26,000 blocks (12 MB).
Peripherals:	Minimum (both versions) 1 printer; can drive printers and graphics terminals.
Language:	PC version: "C," FORTRAN, Assembler, Pascal; VAX version: FORTRAN.
Documentation:	Both versions well-documented; recent operator's manual.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1983.

Data Base: For one quad sheet (about 22 km x 23 km), all terrain factors and ordinary resolution (100m for off-road terrain and 10m for roads and linear features); digitizing requires one man-month. Vehicle, driver, and historical weather data is preprocessed and requires limited preparation time.

CPU time per Cycle: For one quad and normal terrain data resolution, about 6 minutes on PC and 2 minutes on VAX.

Data Output Analysis: Postprocessor gives graphical and textual images for use as tactical decision aids.

Frequency of Use: Varies; used at least several times per year.

Users: U.S. Army I, III, and V Corps; 9th Infantry Division, Training and Doctrine Command, Command and General Staff College, Military Academy, Combined Arms Center, Defense Mapping School, U.S. Army Waterways Experiment Station.

Comments: Upgraded regularly; used as mobility model in major U.S. Army programs.

TITLE: CAMP - Computer Assisted Match Program

MODEL TYPE: Analysis.

PROPONENT: Strategy, Concepts and Plans Directorate, U.S. Army Concepts Analysis Agency, 8120 Woodmont Ave, Bethesda, MD 20814.

POINT OF CONTACT: Major Stafford G. Conley, AV 295-1082.

PURPOSE: CAMP is designed to develop time-phased unit and nonunit movement requirements for a program or planning force in order to support a given scenario and to provide the data in the format required by the strategic mobility model (either MIDAS or TRANSMO) being supported.

DESCRIPTION:

Domain: Sea and air.

Span: Accommodates a global scenario up to seven theaters.

Environment: N/A.

Force Composition: Generates requirements for Army units only.

Scope of Conflict: N/A.

Mission Area: CAMP is a computer system developed to generate the time-phased Army movement requirements needed as input to support transportation models. The term "movement requirements" encompasses all of the characteristics of the cargo and its schedule that put a demand on the transportation system, specifically the origin, destination, estimated weight, dimensions, number of passengers, RDD, and preferred mode of transport for each shipment. These are calculated for unit equipment, personnel, and supplies, as well as for the resupply and placement personnel required to sustain the overseas theater.

Level of Detail of Processes and Entities: Movement requirements are generated for each unit on the force to be moved and include the RDD, availability date, CONUS origin, and theater destination for each unit as well as the unit equipment and accompanying supply and ammunition. The resupply requirements needed to sustain the forces are also generated. They are given in short tons for ammunition and dry resupply (which includes all other classes of supply) and in barrels for POL. All resupply movement requirements include RDD, availability date, CONUS origin, and theater destination.

CONSTRUCTION:

Human Participation: Not required; relies on scheduled changes.

Time Processing: Dynamic, time- and event-step.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Limited by the quality of input.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: The following data bases in magnetic tape form are used: Army Location File, POMCUS Tonnage Tape, Program Force TUCHA, and Force Accounting System Tape.

OUTPUT: Movement requirements can be placed in MORSA formatted tape form for input in the Joint Staff's strategic mobility model, MIDAS, or packaged for input to the USACAA TRANSMO model.

HARDWARE AND SOFTWARE:

Computer:	UNISYS 1100/84.
Storage:	5500 tracks of mass storage required.
Peripherals:	Two 9-track, 6250-byte-per-inch tape drives.
Language:	COBOL and FORTRAN.
Documentation:	Users manual.

SECURITY CLASSIFICATION: Unclassified, but data bases are secret.

GENERAL DATA:

Date Implemented: 1976.

Data Base: One man-month of effort.

CPU time per Cycle: Two hours.

Data Output Analysis: Two weeks.

Frequency of Use: Used approximately 20 times per year.

Users: USACAA.

Comments: N/A.

TITLE: CAM-X - Corps Ammunition Model Expanded

MODEL TYPE: Analysis.

PROPONENT: U.S. Army TRAC-LEE, ATTN: ATRC-LF, Ft. Lee, VA 23801-6140.

POINT OF CONTACT: Bruce Lasswell, AV 687-1050/3449.

PURPOSE: CAM-X is an operations support tool designed to furnish information on how ammunition requests may be satisfied under constraints of equipment availability, transportation networks, and enemy attack.

DESCRIPTION:

Domain: Land and air.

Span: CAM-X handles a wide range of scenarios and transportation networks. The user can select any geographic area where data is available.

Environment: CAM-X models a multi-mode transportation network.

Force Composition: Variable.

Scope of Conflict: Variable.

Mission Area: Transportation system.

Level of Detail of Processes and Entities: Requirements for ammunition are input to the model. Ammunition vehicles are loaded and move over the given network to the user. Vehicles may be attacked when halted. All phases of transportation are considered.

CONSTRUCTION:

Human Participation: Not required--scheduled changes.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Either stochastic, Monte Carlo or basically deterministic as required by the user.

Sidedness: One-sided.

LIMITATIONS: Model requires extensive data input, and is not directly related to combat models.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Transportation network, ammunition demands (from other model outputs or SCORES scenario), destruction probabilities, rebuild times, and unit locations and movement.

OUTPUT: Ammunition delivered, ammunition destroyed, and preferred modes and schedules.

HARDWARE AND SOFTWARE:
Computer: VAX 11/780.
Storage: Variable.
Peripherals: Printer.
Language: FORTRAN IV, GASP IV, and FORTRAN 77.
Documentation: N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1982.

Data Base: N/A.

CPU time per Cycle: Varies.

Data Output Analysis: Two weeks.

Frequency of Use: Cyclical.

Users: U.S. Army Ordnance Missile and Munitions School.

Comments: CAM-X was created using the Models of the Army Worldwide Logistics System (MAWLOGS).

TITLE: Canadian Land Forces Research War Game

MODEL TYPE: Analysis.

PROPONENT: Directorate of Land Operational Research (DLOR) and Operational Research and Analysis Establishment (ORAE), Ottawa, Ontario, K1A OK2, Canada.

POINT OF CONTACT: Mr. A. G. Boothroyd, Director Land Operational Research, (613) 992-8960, AV 842-8960.

PURPOSE: The Canadian Land Force Research War Game is used primarily to provide an objective and detailed simulation of warfare to test the effects of weapon systems and organizations.

DESCRIPTION:

Domain: Land and air.

Span: Accommodates any theater for which map coverage is available. Generally operated in Northwest European and Canadian localities.

Environment: Terrain detail as per maps in use at the preferred 1:10 000 scale. No limitations on night operations. Weather and seasonal inputs can be varied to fit the requirement.

Force Composition: Any mix of BLUE and RED forces can be accommodated; BLUE usually up to brigade group level and RED up to the divisional (+) level.

Scope of Conflict: Can accommodate virtually all conventional weapons and their effects. Primarily conventional warfare but some limited nuclear and chemical effects can be played.

Mission Area: All conventional missions except unconventional warfare.

Level of Detail of Processes and Entities: Entity: The game can be played at various levels. The resolution can vary from individual weapons to company groups. Normally BLUE is at platoon size and RED is at company size but each force has certain major weapons at the individual level. Processes: Stochastic determination of events is used with the exception of close combat. Rule and assessment areas are detailed computer simulations that can stand alone and can be used independently.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic in five-minute time steps.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Real time/game time ratio increases with complexity and size of the game.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None at this time.

INPUT: Scenario, orders, operational concept, tactics or guidelines, weapon effects information, detailed organisation and equipment holdings, and analysis plan.

OUTPUT: Detailed period-by-period record of each piece showing strength, location, status, suppression, and ammunition holdings; detailed records of interactions; and data outputs based on the analysis plan.

HARDWARE AND SOFTWARE:

- Computer: VAX 750.
- Storage: Two 300-MB disk drives.
- Peripherals: Line printers and tape drives.
- Language: FLECS/FORTRAN.
- Documentation: Partial.

SECURITY CLASSIFICATION: War game and simulations unclassified.

GENERAL DATA:

Date Implemented: 1978/79.

Data Base: Four man-months.

CPU time per Cycle: Unknown.

Data Output Analysis: As per analysis programs.

Frequency of Use: One to two game series per year.

Users: Proponents.

Comments: This game and its simulations with minor modifications can be used as an operational war game or as a training war game.

TITLE: CASMO - Combat Analysis Sustainability Model

MODEL TYPE: Analysis.

PROPONENT: USA Concepts and Analysis Agency (CAA), 8120 Woodmont Avenue, Bethesda, MD 20814-2797.
USA Operational Test and Evaluation Agency (OTEA), CSTE-TSR, 4501 Ford Avenue, Alexandria, VA 22302-1458.

POINT OF CONTACT: CAA - Mr. M. Ogorzalek, (301) 295-5302, AV 295.
OTEA - Ms. S. Moore, (703) 756-1688, AV 298.

PURPOSE: CASMO will be used to exploit empirical data produced by operational tests and to analyze the adequacy of the maintenance plan for the new weapon systems and the impact on division maintenance resources.

DESCRIPTION:
Domain: Land.

Span: Army division.

Environment: N/A.

Force Composition: N/A; CSS division requirements for a given type of ground weapon system.

Scope of Conflict: Conventional.

Mission Area: CSS.

Level of Detail of Processes and Entities: Entity: single system under investigation. Processes: calculate and model requirements for scheduled and unscheduled maintenance and combat damage repair, ammunition, and POL; queueing of maintenance and inventory of spare parts; availability vs. requirements for contact and recovery teams.

CONSTRUCTION:
Human Participation: Not permitted.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Deterministic, generates a value as a function of expected value. Stochastic selection of damaged parts and required maintenance packages based on combat damage shotline assessment.

Sidedness: One-sided.

LIMITATIONS: Thirty days of combat scenario.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: VIC or FORCEM data files, which provide the combat scenario for movement, combat damage, time; shotline (line of fire from shooter to target) data file, which provides maintenance requirements for combat damage of

studied system; and system equipment data file, which provides the maintenance policy, RAM data, and parts information.

OUTPUT: Maintenance queueing and resource utilization, backlog requirements for maintenance and spare parts, and parts summaries including demands/fills/usage, PLL/ASL, and costs.

HARDWARE AND SOFTWARE:

Computer:	UNIVAC 1100 (UNISYS).
Storage:	TBD.
Peripherals:	Line printers.
Language:	SIMSCRIPT II.5.
Documentation:	CASMO User's Manual, CASMO Maintenance Manual.

SECURITY CLASSIFICATION: Model without data is unclassified.

GENERAL DATA:

Date Implemented: To be implemented 1Q FY90.

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: Twice per year.

Users: CAA, OTEA.

Comments: Assumptions of the model: transportation assets assumed available for movement of supplies; weapon system failure rate is exponential; combat damage based on shotline; maintenance units not degraded by attrition or relocation.

TITLE: CASTFOREM - Combat Arms Task Force Engagement Model

MODEL TYPE: Analysis.

PROPONENT: TRADOC Analysis Command, White Sands Missile Range (TRAC-WSMR), White Sands Missile Range, NM 88002-5502.

POINT OF CONTACT: C. Denney, (505) 678-1881, AV 258-1881.

PURPOSE: CASTFOREM is used for weapon system and tactics evaluation in brigade and below combined arms conflicts.

DESCRIPTION:

Domain: Combined arms ground conflicts (support helicopters, limited fixed-wing and air defense, and dismounted fire teams).

Span: Extremely flexible; can accommodate any terrain or weapon system for which data is available.

Environment: Uses digitized terrain data. Weather and ambient light conditions are constant throughout the battle. Battlefield obscurants, smoke, and dust are modeled as dynamic clouds.

Force Composition: Combined arms, normally battalion or brigade--equal representation for RED and BLUE.

Scope of Conflict: Conventional warfare with limited chemical and nuclear effects. Directed energy weapons, including lasers and high-powered microwave are modeled.

Mission Area: Primarily intended to model intense Battalion-level battles up to one hour in length.

Level of Detail of Processes and Entities: Very high resolution for conventional and directed energy weapon system with resolution to the item system level. Processes are modeled probabilistically using Monte Carlo techniques.

CONSTRUCTION:

Human Participation: Required for preparing the decision rules set prior to running the model.

Time Processing: The model is event sequenced. Time-step events are possible.

Treatment of Randomness: All events including probability of detection, probability of hit, and probability of kill are stochastic. Line of sight is deterministic.

Sidedness: Two-sided, symmetric treatment. An Expert System combat model.

LIMITATIONS: RAM is not explicitly modeled. Fixed-wing air-to-air is not modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: High-resolution dismounted combat is to be added. Automated inputs from graphics workstations are planned.

INPUT: Voluminous inputs required, including digitized terrain, unit organization, weapon systems performance, sensors, vulnerability data, communications nets, and decision tables to affect each scenario.

OUTPUT: History tape to be postprocessed to yield both statistical and graphical outputs.

HARDWARE AND SOFTWARE:

Computer (OS):	VAX Series using VMS, Univac 1100/92 using EXEC, SUN III workstation, Hewlett Packard 9000/800 series, and SUN IV workstation.
Storage:	Efficient operation calls for at least 8 MB of RAM and 100 MB of MASS storage.
Peripherals:	MASS storage is required while printers and plotters are very convenient. For graphical playback, RAMTEK 9400 series are used.
Language:	SIMSCRIPT II.5
Documentation:	Executive Summary, Methodologies Manual, Users Input Guide, Scenario Writing Guide, and Post Processor Users Guide are available through Defense Technical Information Center.

SECURITY CLASSIFICATION: Model code is unclassified; certain data is classified up to Secret.

GENERAL DATA: Output is generally unclassified.

Date Implemented: 1983.

Data Base: Developing a data base for a new scenario is scenario dependent but generally is three to six months.

CPU time per Cycle: Scenario dependent and machine dependent. Average battalion and brigade scenarios run 1 1/2 hours on VAX 8800.

Data Output Analysis: One to three weeks.

Frequency of Use: Daily.

Users: US Army TRAC WSMR, Picatinny Arsenal, Survivability Management Office, MICOM, Harry Diamond Labs, and Contractor RAM Inc.

Comments: Configuration control policies call for each user to belong to the CASTFOREM user group. A reference version is maintained by TRAC-WSMR. Model release policies are in place and managed by TRADOC Analysis Command, Requirements Program Directorate.

TITLE: CBAM - Combat Base Assessment Model

MODEL TYPE: Analysis.

PROPONENT: Air Base Operability SMO (MSD/YQ), HQ MSD Eglin AFB, FL. 32542

POINT OF CONTACT: Mr. Bob Hume, YQA AV 872-9113.

PURPOSE: The model relates airbase performance, primarily in terms of aircraft sorties generated, to airbase operations in response to RED attack scenarios. In a generalized scenario it can be used as a research and evaluation tool. With base-specific information it can be used as an operations support tool.

DESCRIPTION:

Domain: Land and air around an airbase.

Span: Individual airbase.

Environment: Detailed scale layout of airbase (2D representation) including weather and time of day.

Force Composition: RED air and ground attack forces versus base facilities and BLUE mission aircraft. Has limited air defenses against RED air forces. Has airbase ground defense teams and sensors. Does not model air-to-air engagements.

Types of Conflict: RED weapons include air-to-ground conventional and chemical munitions, missile-delivered conventional and chemical warheads, ground-based SAMs, and spetsnaz-delivered charges and RPGs. BLUE weapons are limited to AAA guns and SAMs.

Mission Area: Base recovery and sortie generation.

Level of Detail of Processes and Entities: Individual entities are modeled (i.e., aircraft, buildings, equipment, and eventually critical personnel and resources as opposed to groups or organizations). Only one airbase is modeled at one time. Individual events are tallied and can be displayed as graphs after the simulation is completed. Most activities are modeled as fixed time delays.

CONSTRUCTION:

Human Participation: Not permitted while simulation is running. The set-up of the scenarios is very interactive and provides feedback during layout and attack designs.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Deterministic with a mixture of expected-value functions, counting of deterministic events and queues, and random-number generators with fixed-seed streams.

Sidedness: Two-sided: RED attack on BLUE facilities Asymmetric: different functions are modeled for each side. One side nonreactive: RED attacks are inputs; BLUE reaction is modeled.

LIMITATIONS: Capacity is limited by computer memory rather than by model design. 2D representation of facilities. Cookie cutter damage functions.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Addition of critical personnel and resources as simulation constraints. Version for single-screen hardware configuration.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer:	MSDOS/PC-AT compatible (Z-248).
Storage:	2 MB RAM and 20 MB hard drive.
Peripherals:	EGA monitor and board plus monochrome text monitor and board (EGA only for next version). Dot matrix printer, color plotter, and mouse.
Language:	"C."
Documentation:	User's manual and analyst manual (draft copies).

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Gathering valid data could be time consuming. Entry of data entails simply filling in the blanks. Modifying data bases is very simple.

CPU time per Cycle: Depending on scenario, from a few minutes to a half an hour.

Data Output Analysis: Graphs of predefined data sets can be plotted in minutes. An event calendar can be searched using Enable data base functions.

Frequency of Use: Because model is still in development, practical usage has not yet been determined.

Users: Variety of developmental and operational organizations have expressed interest.

Comments: Effort to produce single-screen version has been funded. Funds for critical personnel and resources upgrade has been identified. Widespread distribution of model by the first quarter of FY 90.

TITLE: CCBM - Generic Crew-Centered Bomber Mission Model

MODEL TYPE: Analysis.

PROPONENT: AAMRL/HE, Wright-Patterson AFB, OH 45433-6503.

POINT OF CONTACT: Dr. Robert G. Mills, (513) 255-7588, AV 785-7588.

PURPOSE: CCBM is a research and evaluation tool used to investigate individual and crew performance. It can also be used as an operation support tool (decision aid) to examine information flow and requirements, individual and crew workload, crew sizing, crew procedures, situational awareness, and predicted impact of system changes upon mission performance.

DESCRIPTION:

Domain: Air.

Span: Local.

Environment: Defined by the user as a function of bomber mission. The model does not currently have terrain or weather capabilities.

Force Composition: Crew performance of individual bomber crew members can be modeled.

Scope of Conflict: Dependent upon user's problem and model development.

Mission Area: Dependent upon user's problem and model development.

Level of Detail of Processes and Entities: Lowest entity modeled is individual crew members' tasks. Processes are dependent upon user's problem and model development.

CONSTRUCTION:

Human Participation: Human participation is required for model development. The user can specify a time segment during which the model will collect snapshot data during execution.

Time Processing: Dynamic, time-step and event-step, and closed form.

Treatment of Randomness: Stochastic, based on direct computation with Monte Carlo used in the simulation of sensor effectiveness and the ability to degrade offensive and defensive systems performance.

Sidedness: One-sided.

LIMITATIONS: CCBM currently has low-level penetration and target acquisition segments. Terrain and weather are not included.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Weapon delivery and egress segment are planned in the next effort beginning April 1989. Offensive systems, terrain, and weather will also be included. A follow-on effort will complete the model from takeoff to landing including refueling.

INPUT: Crew member task performance parameters, scenario and avionics parameters, weapons configuration, threats, and targets (e.g., relocatable).

OUTPUT: Computer printouts, raw data, and statistical analyses of crew member task performance parameters; mission performance data such as targets acquired, etc.; and avionics parameters such as distance from waypoints and time of arrival of waypoints along with weapons configuration, threat, and target information.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a VAX computer with a VMS operating system that includes Screen Management facility.
Storage:	529 blocks (270.8 KB) needed before data bases are created.
Peripherals:	VT-100 or compatible terminal.
Language:	FORTRAN.
Documentation:	Technical documentation is available; there are no DDC accession numbers.

SECURITY CLASSIFICATION: Unclassified without a given problem, structure parameters, and data. CCBM is an unclassified computer simulation model.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Creation of the data base is interactive, with the user utilizing a human-computer interface to help with inputting the physical and crew function files.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: N/A.

Users: CCBM has recently become available for field application. Aside from AAMRL, there are currently no other users.

Comments: Model segments are linked in a way that permits execution of individual segments. For example, a target acquisition segment can be executed without low-level penetration. CCBM's structure consists of individual modules that provide model development flexibility in that an entire model does not have to be recoded in order to be modified. The user needs to modify only those modules that are affected.

TITLE: CCOMEM - Conventional Collateral Mission Effectiveness Model

MODEL TYPE: Analysis.

PROPONENT: Boeing Military Airplanes, Operations Analysis Organization, P.O. Box 7730, M/S K80-33, Wichita, KS 67277-7730.

POINT OF CONTACT: Joetta C. Mark, (316) 526-2810.

PURPOSE: The CCOMEM model is evaluates aircraft capability against naval and land surface forces. It is a Monte Carlo computer simulation used in campaign mission effectiveness studies. It determines outcomes of multiple offense and defense encounters during the attack phase of a mission. The primary campaign roles of CCOMEM are antishipping and antimobile land scenarios in which a coastal region of army and naval forces is under air attack. Defensive engagements from the land and surface elements and offensive engagements from the attacking aircraft are modeled with respect to the user scenario.

DESCRIPTION:

Domain: Air, land, and sea.

Span: The model is used in campaign mission effectiveness studies and analyses of air attacks on land and surface forces.

Environment: Statistical terrain features based on typical DMA data. The data is used to generate line-of-sight statistics as a function of azimuth and altitude, then a Monte Carlo randomization determines whether target acquisition is possible.

Force Composition: Two-sided. RED on BLUE or BLUE on RED. Various aircraft types, AIs SAMS, AAA, ships, tanks, trucks, etc.

Scope of Conflict: Conventional weapons include air-to-air and air-to-ground missiles, SAMs, and AAA. No nuclear or chemical effects are considered.

Mission Area: Aircraft effectiveness studies, antishipping and antimobile land element campaigns, and conventional standoff and attack capability analysis.

Level of Detail of Processes and Entities: Movement is modeled for each individual player, including attacking airborne platforms (bombers and fighters), AIs, SAMs, AAA, tanks, trucks, and ships. The initial position, turn points or heading, and altitude and speed determine the successive positions of each offensive and defensive element that may take part in the scenario. The numbers of players may be from one-on-one to many-on-many. The defensive and offensive capabilities are used to control detection ranges, weapon launch ranges, hit and kill probabilities, and maneuvers. Encounters between various offensive and defensive elements are evaluated individually, using Monte Carlo techniques.

CONSTRUCTION:

Human Participation: Required for input data base preparation and planning only. After execution begins, human participation is not normally allowed.

Time Processing: Dynamic, event-driven.

Treatment of Randomness: Monte Carlo determination of player encounters and detections based on input probabilities.

Sidedness: Two-sided, asymmetric. The attacking aircraft are modeled at a higher level of fidelity than defensive elements.

LIMITATIONS: Does not simulate missile flyout. All players must be mobile. All ships within a sailing formation must have the same velocity. The model has no capability for defenses against deck launched AIs.

PLANNED IMPROVEMENTS AND MODIFICATIONS:

INPUT: Aircraft Sorties (if fixed flight), weapon loading and launch parameters, basic movement parameters for all players, detection contours, attack priorities, and probability of kill data.

OUTPUT: Attacker attrition, target kill statistics, position information for subsequent graphics analysis, and complete time-ordered event trace.

HARDWARE AND SOFTWARE:

Computer:	APOLLO Workstation with DOMAIN IX operating system (Previously executed on VAX 11/780 computer with VMS)
Storage:	475K bytes, including input files.
Peripherals:	None necessary. One printer if hardcopy is desired. Graphical terminal for animated playback with plotter for hardcopy.
Language:	FORTRAN IV and FORTRAN 77.
Documentation:	User's manual that is not completely current with model updates. Boeing Document Number: D500-10197-1

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Mission planning and scenario development normally requires several weeks. Tabular data may take several months to collect or generate.

CPU time per Cycle: Dependent on data base size and numbers of players. A typical scenario can take several hours.

Data Output Analysis: Results take little time to analyze but may lead to more model executions.

Frequency of Use: Varies by priority and requirements; has not been used extensively since 1986.

Users: BMA, Operations Analysis.

Comments: N/A.

TITLE: CEM - Concepts Evaluation Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: William T. Allison, AV 295-5236.

PURPOSE: CEM is used primarily to analyze force effectiveness in theater-level operations. It is designed to provide a tool to assess the effectiveness of different mixes of forces and resources and to estimate ammunition, equipment, and personnel requirements.

DESCRIPTION:

Domain: Land and air.

Span: Accommodates any theater given a data base. Has been used in NEA, SWA, and Central Europe.

Environment: Terrain consists of three types representing good cross-country maneuverability, marginal cross-country maneuverability, and road bound. Terrain is described in rectangular bands. Natural and man-made barriers are also represented. Each 12-hour division-level cycle represents the average proportion of day and night.

Force Composition: Combined forces; BLUE and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All conventional missions except unconventional warfare.

Level of Detail of Processes and Entities: Simulates command decisions at four levels from the theater to the division. Force inputs as BLUE battalion and RED regiment. Combat occurs between RED divisions and BLUE brigades along a continuous FEBA. Accommodates up to 70 BLUE and 125 RED divisions with up to 48 types of weapons. Aircraft are aggregated into air defense fighters and tactical fighters. The latter are given daily missions of CA, AR/I, or CAS. Attrition to CA and AR/I is probability of kill. Attrition to CAS and divisional personnel and equipment is derived from results of a high resolution simulation used to extrapolate for the actual weapons in the CEM engagements. Logistics are highly aggregated. Movement of FEBA is determined by equipment losses.

CONSTRUCTION:

Human Participation: None; model is fully automated.

Time Processing: Dynamic, time-step based on a 12-hour division-level cycle.

Treatment of Randomness: Deterministic, expected value combat simulation.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Does not model breakthrough, airborne assaults, effects of engineer or EW.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Terrain map; troop lists; TOEs (personnel, ammo, POL, other supplies, tanks, APCs, helicopters, anti-tank missiles, and artillery); shooter-target results from high resolution simulation; resupply and replacement rates (personnel, ammo, POL, other supplies, and weapons); arrival schedule for resupply, reinforcing artillery battalions, and maneuver units; and FEBA movement tables.

OUTPUT: Computer printout stating (periodic) FEBA locations, posture profiles, state of opposing forces, resources expended, KIA, WIA, CMIA, and DNBI; and weapons hit, destroyed, damaged, abandoned, and repaired. Graphic (plotter or color CRT) display of same results.

HARDWARE AND SOFTWARE:

Computer:	UNISYS 1100/84; CRAY XM-P/48.
Storage:	1,000,000 decimal words.
Peripherals:	Two tape drives or disks; one printer.
Language:	ASCII FORTRAN.
Documentation:	CAA-D-85-1, Volume I, Technical Description, January 1985 (Revised October 1987); CAA-D-85-1, Volume II, User's Handbook, August 1985.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Two months for acquisition; 18 man-months for preparation.

CPU time per Cycle: 36 hours (for 180 days simulation) on UNISYS 1100/84; 4 hours (for 180 days simulation) on CRAY XM-P/48.

Data Output Analysis: Two months.

Frequency of Use: 400 times per year.

Users: U.S. Army Concepts Analysis Agency.

Comments: N/A.

TITLE: CEOPS - Communication-Electronics Operator Positioning System

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Electronic Proving Grounds, ATTN: STEEP-(T-E), Fort Huachuca, AZ 85613-7110.

POINT OF CONTACT: Mr. Steven C. Cooper, (602) 538-4953, AV 879-4953.

PURPOSE: CEOPS is an operational support tool (decision aid). An operator- and unit-oriented system, it builds simulated tactical deployments. CEOPS is used to assign the positions and operating parameters of the individual communications-electronics equipment.

DESCRIPTION:

Domain: Land, air, and limited space and naval.

Span: Accommodates any theater depending on data base. Can model individual equipment to full corps and above deployments.

Environment: N/A.

Force Composition: Joint and combined, BLUE, GREY, and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All phases of conventional warfare.

Level of Detail of Processes and Entities: CEOPS uses deployment-independent, deployment-dependent, and supporting data bases. Deployment-independent data is generic information about the composition and organization of units and about positioning of operators relative to the boundaries of their units. Rules are presented that can, in most cases, deploy the operators who are assigned with some supporting or supported unit. Deployment-dependent data describes the task organization structure in the deployment, and assigns and positions actual units and their operators. Other inputs are used as needed to resolve ambiguities in net assignments, to assign special operators, to ensure that units do not inappropriately cross the line of own troops, to assign frequencies to nets, and to provide equipment parameters to each deployed operator.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Static.

Treatment of Randomness: Various user-selectable probability distributions are used in the assignment of specific location data to operators.

Sidedness: N/A.

LIMITATIONS: Special case processing is available to handle unusual resource allocations or rules.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Incorporation of graphics workstations capability.

INPUT: Generic, task-specific, and special-case deployment data is required for the ✓-E systems represented in the simulated tactical deployment.

OUTPUT: Simulated tactical deployment(s).

HARDWARE AND SOFTWARE:

Computer:	CYBER 180 Model 830.
Storage:	Variable; requirements can be adjusted.
Peripherals:	Optimum number of disk and tape drives varies; variable mass storage requirements in size of data files determine requirements.
Language:	SLACS 5 (an extended FORTRAN 77).
Documentation:	Extensively documented.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1982.

Data Base: Preparation of a new corps-size deployment with appropriate RED forces requires one year. Modification for specific test system requires one to two months, depending on system.

CPU time per Cycle: Depends on deployment size and number of equipment to be evaluated. Corps-size deployment can take 100 hours of CPU time.

Data Output Analysis: Hard-copy printouts disk files.

Frequency of Use: Varies.

Users: USAEPG. Numerous simulated tactical deployments have been created for a variety of government agencies.

Comments: The model is not machine dependent. It does, however, take advantage of the CDC CYBER 60-bit word for optimization of data storage and access, and would require modification for other environments.

TITLE: CFARC Cloud-Free Arc Simulator

MODEL TYPE: Analysis.

PROPONENT: USAF Environmental Technical Applications Center (USAFETAC/DNY), Scott AFB, IL 62225-5438.

POINT OF CONTACT: Capt. David J. Ulsh, (618) 256-5412, AV 576-5412.

PURPOSE: This program was developed by USAF Environmental Technical Applications Center and the Air Force Geophysics Laboratory to perform sensitivity analyses of potential ground-based lasers sites by generating downtime statistics, i.e., duration of cloudy conditions along a line-of-sight from the ground to an orbiting satellite. Downtime statistics can be accumulated for systems of 1 to 25 sites.

DESCRIPTION:

Domain: Surface-to-orbiting satellite. The program is designed to handle mobile ground sites (e.g., ships).

Span: Global. Accomodates any theater as long as there is a sufficient cloud cover data base.

Environment: Provides data for a 24-hour application.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: CFARC produces downtime (duration of cloud conditions) statistics for systems of 1 to 25 sites simultaneously. Seasonal and diurnal variations in each site's cloud cover distribution are accounted for in the data-compacted input parameters.

CONSTRUCTION:

Human Participation: None.

Time Processing: Dynamic, time-step simulator.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: Maximum of 25 surface sites can be tested simultaneously. Terrain obstructions are not modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Mean sky cover and cloud cover scale distance. The scale distance is a modeling parameter that is determined by the character of the cloud cover at a site. Small-scale distances are associated with puffy, cumuliform clouds whereas large-scale distances are associated with stratiform clouds. The data base required to run the model can be obtained from USAFETAC.

OUTPUT: Downtime duration statistics are accumulated in user-defined time categories for a system of ground sites.

HARDWARE AND SOFTWARE:

Computer:	Amdahl 470V8 with MVS/SP operating system.
Storage:	70 KB required for software and data.
Peripherals:	Printer is recommended but not required.
Language:	FORTRAN 77.
Documentation:	Fully documented source code with a user's manual.

SECURITY CLASSIFICATION: Unclassified. However, this program contains critical technology releasable only to DOD and their contractors.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Requires approximately one man-week to prepare a data base of 25 sites.

CPU time per Cycle: Depends on the number of sites to be processed simultaneously. For one site, .12 seconds. For 25 sites, 3.6 seconds.

Data Output Analysis: Generates tables of system downtime statistics.

Frequency of Use: Unknown.

Users: Det 50/2WS Onizuka AFB, Air Force Geophysics Lab, Air Force Weapon Lab.

Comments: None.

TITLE: CFAW - Contingency Force Analysis Wargame

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency (CSCA-SPC), 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: Mr. John DePalma, (301) 295-4721, AV 295-4721.

PURPOSE: CFAW is used primarily to examine both operation plans and contingency plans and to analyze potential conflict in nonmajor theaters worldwide.

DESCRIPTION:

Domain: Land, air, and over-the-shore naval operations.

Span: Scale depends on specific study needs. Reasonable span ranges from corps to small theater.

Environment: Hex-based. Each hex edge incorporates 1 of 10 possible types of road and off-road trafficability factors. Each hex is one of seven terrain types, which include mountains, hills, null, flat, swamp, urban, and water. Hex size is an input parameter; the current model is limited to a 49x49-hex map. Weather, time of day, and day and night are modeled.

Force Composition: Combined and joint forces can be modeled.

Scope of Conflict: Conventional conflict with rear area and noncontiguous FLOT. Nuclear and chemical play is limited to initial effects (no effects of contamination, persistence, collateral damage, etc.).

Mission Area: Air (DCA, CAS, BAI), direct and indirect fire (including TBM and rockets), air defense, airlift (including airborne and airmobile), and barrier operations are represented.

Level of Detail of Processes and Entities: Land combat units can be modeled from company to division as discrete entities with brigade/regiment being the preferred entity size. Units are collections of a maximum of 10 direct and indirect fire weapon types, each having a descriptive data base of acquisition and kill probabilities, fire distribution, and other input parameters. Attrition on units in direct fire combat is assessed through a differential equation mechanism. Combat is automatic when a unit enters a hex that has a common boundary with a hex containing an enemy unit. Model is a single-echelon command and control; players must give orders to each unit played for movement. Air units are modeled as squadrons of individual aircraft that can be given ground attack, defensive counter-air, or escort missions.

CONSTRUCTION:

Human Participation: Required for all unit mission and movement decisions.

Time Processing: Dynamic, time-step. Game time to real time is variable.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Altitude is not played, which degrades air defense fidelity. Player span of control limits practical number of entities per side to approximately 100. Player decision variability does not permit replication of a specific game. Small unit combat, to include SOF-type activities, is not modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Enhanced logistics effects, improved ability to divert air missions to immediate targets, and unit activity postures are planned.

INPUT: Units: weapon counts, ground speed, supply consumption rates, indirect fire damage capability and range, unit size, and designation. Scenario: terrain description. Attrition: individual weapons data, terrain effects on weapon densities, probabilities of detection and kill for each weapon target pairing, expected aircraft specific exchange ratios, and air defense effectiveness. Game: initial map position and arrival time for each unit played.

OUTPUT: Current status (strength, position, and activity) and map picture of playing screen as desired during game. Strengths over time of weapons by location, activity, type, etc. as desired by analyst in tables and charts.

HARDWARE AND SOFTWARE:

Computer:	VAX 780 with VMS.
Storage:	100K words.
Peripherals:	Five DEC VT102 terminals, three Ramtek RGB monitors with driver, one printer.
Language:	FORTRAN, "C."
Documentation:	Under development.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Six to eight weeks (given information availability).

CPU time per Cycle: Approximately 20 minutes of each gaming hour.

Data Output Analysis: Postprocessor/analytical aids, hard copy, order streams.

Frequency of Use: Six to eight different war game scenarios per year.

Users: USACAA operates war game for DA Staff, Army agencies, and major commands.

Comments: USACAA performs configuration control, model improvements, and maintenance.

TITLE: CHEMCAS III - Chemical Casualty III

MODEL TYPE: Analysis.

PROPONENT: United States Army Chemical School (USACMLS), ATTN: ATZN-CM-CC, Ft. McClellan, AL 36205-5020.

POINT OF CONTACT: Mr. Tom Collins/CPT Michael O. Kierzewski, (205) 848-3174/3659, AV 865-3174/3659.

PURPOSE: CHEMCASIII is used to analyze weapons systems effectiveness against targets. It determines casualties and provides quantitative estimates of agent deposition and dosage levels on target. CHEMCASIII is used primarily to compare various weapons systems and to be a casualty levels feeder model for larger force-on-force models. The dosage and deposition effects are actually calculated by the NUSSE III model used as a module for CHEMCAS III.

DESCRIPTION:
Domain: Land.

Span: Accommodates any theater with adequate weather and terrain data base. Meteorological data comes from the EOSAEL CLIMAT Data Base.

Environment: N/A.

Force Composition: Currently Army maneuver units only.

Scope of Conflict: Chemical weapons effects only. No nuclear weapons or the high explosive effects from chemical munitions are modeled.

Mission Area: All missions and weapons combinations that can be used to deliver chemical munitions.

Level of Detail of Processes and Entities: For artillery-delivered munitions, CHEMCASIII uses volleys from four or six tube artillery batteries. Target units can be handled down to company level but the normal target unit is the battalion. Target units are stationary, and firing units are limited in the number of rounds available to them (based on unit basic loads and resupply rates).

CONSTRUCTION:
Human Participation: Required to provide the interface between modules and to perform the fireplanning for the model.

Time Processing: Dynamic in that model treats dosage at different times from the first round impacts on the target.

Treatment of Randomness: Stochastic process used to model aim point and dispersion errors as independent bivariate normal random variables.

Sidedness: One-sided.

LIMITATIONS: Model does not currently consider bombs or missiles for dissemination of chemical agents. In addition, the applicability of

CHEMCASIII is limited by the database limitations of NUSSE III. For example, NUSSE III parameters are derived for limited types of soil and vegetation.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Addition of chemical agent bombs and missiles; a version of CHEMCASIII that will run on a personal computer (Zenith) is under development.

INPUT: Target size and protection level, current weather data (temperature, stability, windspeed), terrain data (vegetation, soil and surface type), chemical agent used, and the munition used for delivery.

OUTPUT: Percentage of the target that is exposed to different dosages or deposition rates at a specified time after impact of the first round and the percentage of personnel in the target area who will become casualties (threshold, incapacitation, or lethality).

HARDWARE AND SOFTWARE:

Computer:	Currently designed to run on the UNISYS 1100/70 resident at Aberdeen Proving Ground-Edgewood Area.
Storage:	Approximately 1.5 MB with 1 MB dedicated to NUSSE III.
Peripherals:	Minimum requirements: a VT100 terminal and a printer.
Language:	UNISYS FORTRAN.
Documentation:	Under revision. Current documentation from Science Application International Corporation dated February 1988.

SECURITY CLASSIFICATION: Unclassified, but weapons effects data bases are classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: One hour required to prepare the inputs for one run.

CPU time per Cycle: Total run time including NUSSE III is 10 minutes. If NUSSE III were run previously, the run time for CHEMCASIII would be three-five minutes.

Data Output Analysis: No real analysis performed.

Frequency of Use: Used weekly by USACMLS.

Users: USACMLS and CRDEC.

Comments:: Configuration control exercised by USACMLS.

TITLE: CISCIAD - Combat Identification System COMO Integrated Air Defense

MODEL TYPE: Analysis.

PROPONENT: TRADOC Analysis Command - White Sands Missile Range (TRAC-WSMR), White Sands Missile Range, NM 88002-5502.

POINT OF CONTACT: Mr. Daniel Bretl, (505) 678-4287, AV 258-4287.

PURPOSE: CISCIAD is a research and evaluation tool used to conduct high resolution air defense studies, including combat identification.

DESCRIPTION:

Domain: Land and air.

Span: Regional.

Environment: Uses digitized terrain, 100 meter squares with vegetation. Time of day and weather reflected in input data for weapon systems.

Force Composition: BLUE air defense and aircraft versus RED aircraft.

Scope of Conflict: Conventional.

Mission Area: Air defense.

Level of Detail of Processes and Entities: Individual fire units and aircraft are simulated, up to a corps level of air defense. Command and control (fire levels), ECM jamming, and combat identification systems are also modeled.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, critical event-step model.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, RED is nonreactive.

LIMITATIONS: The maximum number of fire units and aircraft that can be played are 300 and 1024, respectively. Nuclear and chemical warfare and logistics are not modeled. There is no ground-to-ground combat.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Scenario, weapon characteristics, aircraft flight paths, ECM jamming data, combat identification system data, and command and control element characteristics.

OUTPUT: Computer printout of RED and BLUE kills, time of kills, engagement ranges, etc. Graphics playback of movement, engagements, and kills.

HARDWARE AND SOFTWARE:

Computer (OS): VAX/VMS operating system.
Storage: 150K.
Peripherals: Printer and graphics.
Language: FORTRAN 77.
Documentation: Veda, 103066-87U/P1035, User's Manual, 6 May 87.

SECURITY CLASSIFICATION: Unclassified, but data bases are usually classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Six months.

CPU time per Cycle: One to six hours on VAX 8600.

Data Output Analysis: Postprocessor.

Frequency of Use: Several times per year.

Users: MICOM, CAA, and TRAC-WSMR.

Comments: CISCIAD is the version of COMO used by and maintained by TRAC. It was developed from the CIAD model which originated at the SHAPE Technical Centre.

TITLE: CLDGEN - Cloud Scene Simulator

MODEL TYPE: Analysis.

PROPONENT: USAF Environmental Technical Applications Center, Environmental Simulations, Scott AFB, IL 62225.

POINT OF CONTACT: Maj Bill Barattino, 694-0363 and ILT John Rupp, AV 576-5412.

PURPOSE: The CLDGEN is used to generate statistically correct cloud coverage for any specified point on the earth.

DESCRIPTION:

Domain: Air.

Span: Global, using data base prepared by USAFETAC.

Environment: Atmosphere.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: User enters location and senith angle to gain output of cloud distribution for the location.

CONSTRUCTION:

Human Participation: Required for parameter inputs.

Time Processing: Static.

Treatment of Randomness: Random number generator used to provide climatologically representative values. Failure to reset generator will result in same output as previous run.

Sidedness: One-sided.

LIMITATIONS: All clouds assumed to be a single layer at 15,000 feet. No attempt is made to model various cloud types.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Changes to alleviate above limitations are planned.

INPUT: Specified ground location, zenith angle, and time.

OUTPUT: Raw data.

HARDWARE AND SOFTWARE:

Computer: Tape available in ASCII format. USAFETAC can provide data for almost any type of computer system.

Storage: N/A.
Peripherals: N/A.
Language: N/A.
Documentation: N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: March 1989.

Data Base: N/A.

CPU time per Cycle: Unknown.

Data Output Analysis: N/A.

Frequency of Use: Continuously used in an AFCSA study.

Users: Model created specifically for AFCSA. Other use authorized only by USAFETAC.

Comments: N/A.

TITLE: COMBAT IV

MODEL TYPE: Analysis.

PROPONENT: Defense Nuclear Agency, NATO, SHAPE, and The BDM Corporation.
CAA, SAC

POINT OF CONTACT: Edmund J. Bitinas, (703) 848-5246.

PURPOSE: COMBAT IV is a research and evaluation tool used to assess weapon system effectiveness; force capability and requirements; courses of action; force mix options; force effectiveness and resource planning; and combat development for current or new doctrine, competing strategies, and policy study in the areas of theater warfare.

DESCRIPTION:

Domain: Air and land, and limited naval (at the theater level).

Span: Theater or regional.

Environment: Terrain features represented in abstract terms at corps-level or division sector-level in depth. Weather and time of day effects also modeled.

Force Composition: Air and land forces; limited naval.

Scope of Conflict: Conventional, chemical, and nuclear.

Mission Area: All aspects of theater and regional campaign analysis.

Level of Detail of Processes and Entities: Explicit SAM fire units by type, ground forces by brigade equivalent, explicit SAM fire units by and surface to surface missile launchers by type, and explicit air bases.

CONSTRUCTION:

Human Participation: Not required. Model interruptable with scheduled changes.

Time Processing: Dynamic with one hour time-step.

Treatment of Randomness: Basically deterministic.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Ground force representation aggregated at brigade level.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Added fidelity in ground force representation.

INPUT: Terrain geometry, characteristics, weapon system capabilities, force size, deployments and allocations, munition stockpiles, decision rules for force employment, scenario, scheduled force employment and allocation changes, and scheduled reinforcements.

OUTPUT: Printouts over time and full, postprocessed graphic output for trends over time and map graphics.

HARDWARE AND SOFTWARE:

Computer:	VAX/VMS family.
Storage:	10 MB.
Peripherals:	Printer and hard copy graphics.
Language:	VAX Pascal. Postprocessors in FORTRAN 77 with DISSPLA graphics interface.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: July 1984.

Data Base: Three to six man-months (various Central Region scenario data bases are available).

CPU time per Cycle: Eight minutes per day of combat.

Data Output Analysis: Postprocessor provides graphics as well as raw data output.

Frequency of Use: Constant.

Users: NATO HQ Brussels, Belgium; SHAPE Technical Center; U.S. Army Concept Analysis Agency; LTV Corporation; the BDM Corporation.

Comments: Requires operational effectiveness data as input, typically obtained from more detailed models.

TITLE: Combat Model ELAN+

MODEL TYPE: Analysis.

PROPONENT: TRADOC Analysis Command - White Sands Missile Range (TRAC-WSMR), White Sands Missile Range, NM 88002-5502.

POINT OF CONTACT: Dr. H. M. Sassenfeld, (505) 678-1615, AV 258-1615.

PURPOSE: ELAN+ is a two-sided, event-sequenced, deterministic/stochastic combat model for up to brigade-level combat. Activities modeled are maneuver, acquisition, direct fire, fire support, mines, smoke, terrain, and weather. All actions can be triggered by combat situation and specifiable doctrine.

DESCRIPTION:

Domain: Land (air).

Span: Platoon to brigade.

Environment: Terrain.

Force Composition: Combined forces.

Scope of Conflict: Conventional.

Mission Area: Land combat.

Level of Detail of Processes and Entities: Single weapon system geometric and time resolution specifiable.

CONSTRUCTION:

Human Participation: Required for decisions.

Time Processing: Dynamic.

Treatment of Randomness: Either deterministic or stochastic.

Sidedness: Two-sided, symmetric.

LIMITATIONS: None, except total run time depending on specified resolution.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Handling of combat support.

INPUT: Routes of forces, maneuver and fire support schedules, and weapon performance data from keyboard.

OUTPUT: Weapon effectiveness measures and force losses.

HARDWARE AND SOFTWARE:

Computer (OS): Microcomputer, UNIX.
Storage: 8 MB RAM, 50 MB hard disk.
Peripherals: Printer or plotter.

Language: Hewlett Packard Basic (Pascal), FORTRAN.
Documentation: Annotated source code, user manual.

SECURITY CLASSIFICATION: Unclassified, classified with weapon-performance data.

GENERAL DATA:
Date Implemented: 1987.

Data Base: Several days.

CPU time per Cycle: N/A.

Data Output Analysis: Via concurrent numerical and graphic representation.

Frequency of Use: Continuous.

Users: TRAC-WSMR, TRAC-FLVN.

Comments: None.

TITLE: COMET - Calculation of Missile Earth Trajectories

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SASM), The Pentagon, Room 1D431, Washington, DC 20330.

POINT OF CONTACT: Capt Steve Misra, AFCSA/SASM, (202) 697-9702, AV 227-9702.

PURPOSE: The COMET model is designed to accurately and rapidly integrate the translational equations of motion for rocket-powered flight through the earth's atmosphere and gravitational field. Program output is a computed trajectory of vehicle position and velocity.

DESCRIPTION:

Domain: Air and exoatmospheric.

Span: Global.

Environment: All weather.

Force Composition: BLUE or RED.

Scope of Conflict: Nuclear.

Mission Area: Strategic nuclear.

Level of Detail of Processes and Entities: Entity: individual ICBM. Processes: ICBM mission defined in terms of vehicle weight/payloads.

CONSTRUCTION:

Human Participation: Required for setup parameters only.

Time Processing: Static.

Treatment of Randomness: N/A.

Sidedness: One-sided.

LIMITATIONS: Time consuming.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Number of stages, launch altitude, latitude, longitude, initial velocity vector, launch azimuth, final altitude, and tilt angle.

OUTPUT: Printout of computed trajectory of vehicle position and velocity.

HARDWARE AND SOFTWARE:

Computer: IBM 370/3032.
Storage: N/A.
Peripherals: N/A.

Language: FORTRAN.
Documentation: COMET User's Manual.

SECURITY CLASSIFICATION: Source code is unclassified.

GENERAL DATA:
Date Implemented: 1984.

Data Base: Few hours.

CPU time per Cycle: Typical case takes about one minute.

Data Output Analysis: Varies.

Frequency of Use: Varies depending on SASM requirements.

Users: SASM.

Comments: None.

TITLE: COM/EW Tactical Communications/Electronic Warfare

MODEL TYPE: Analysis.

PROPONENT: DoD Electromagnetic Compatibility Analysis Center, North Severn, Annapolis, MD 21402-1187.

POINT OF CONTACT: T. Treadway, (301) 267-2354, AV 281-2354.

PURPOSE: COM/EW is a research and evaluation tool used to analyze system effectiveness (with application to force capability and requirements effectiveness). It provides the user with an interactive automated capability to evaluate the performance of COM systems, electronic IR systems, and electronic ELS in a hostile electromagnetic environment. It is suited to analyze hypothetical tactical and training environments, and is applicable to the analysis of interactions between the following: point to point communications using conventional, direct sequence spread spectrum, or frequency hopping spread spectrum techniques; jamming using conventional or repeater techniques; emitter location systems using time-of-arrival, interferometer, rotating beam, or multibeam techniques; and intercept receivers using conventional techniques.

DESCRIPTION:

Domain: Land with limited air and naval operations.

Span: Regional simulation and analysis.

Environment: Terrain effects considered, given DMA Level 1 DTED for the region of interest. Ground constants and atmospheric parameters also considered. One of three levels of ambient noise can be selected. Ionospheric parameters, date, and sunspot number used in VAX implementation.

Force Composition: RED and BLUE; independent of administrative and organizational affiliation.

Scope of Conflict: Primarily conventional warfare. Nonelectromagnetic combat effects and nuclear detonation effects not considered.

Mission Area: Communications, SIGINT, and communication jamming missions.

Level of Detail of Processes and Entities: COM/IR/ELS station, link, and net performance evaluated based on specified geographic deployment (snapshot) and detailed C-E system characteristics. Effects of station motion not considered. COM performance analyzed considering RED and BLUE force jamming with limited consideration of BLUE force communications contention. Results include prediction of AS, BER, and status. IR performance analyzed similarly to COM without consideration of BLUE force communications. ELS performance analyzed considering noise effects only. Results include prediction of the accuracy of DOA and TOA measurements on targeted emitters and associated confidence in those measurements based on CEP.

CONSTRUCTION:

Human Participation: Required to define forces (deployment, C-E system characteristics) and select analysis processes.

Time Processing: Static.

Treatment of Randomness: Deterministic (expected value) and stochastic (Monte Carlo).

Sidedness: One-sided.

LIMITATIONS: Up to 50 interfering/target nets with less than 50 stations each and 100 frequencies (between 1 MHz and 20 GHz) can be considered in analysis. Nonlinear electromagnetic effects and operational duty factors not considered.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Interface with equipment characteristics data base and small-scale operational enhancements.

INPUT: Data Base Module requires net (deployment, C-E system characteristics) data. Analysis Module accesses net data files and topographic data files, and requires analysis directives.

OUTPUT: Displays and printouts of data and results. VAX version also produces graphic plots. Postprocessor allows merging of results.

HARDWARE AND SOFTWARE:

Computer:	A version runs on the UNISYS 1100 under the EXEC 8 operating system. A version runs on the VAX computer under the VMS operating system.
Storage:	VAX program: 2.7 MB. UNISYS program: 2.15 MB. Additional storage requirements depend on deployment size and topographic data base.
Peripherals:	One printer, one graphics suite (VAX only-optional), and one terminal.
Language:	FORTRAN.
Documentation:	Each version separately documented.

SECURITY CLASSIFICATION: Unclassified program, but data and results may be classified.

GENERAL DATA:

Date Implemented: 1979.

Data Base: Population of large data base can take several man-days.

CPU time per Cycle: Depends on data base size. Generally, requires several minutes of CPU time.

Data Output Analysis: Can be interpreted directly.

Frequency of Use: Varies by command.

Users: DoD, ECAC, JEWC, and US Army CM/CCM Center.

Comments: Originally developed by ECAC for US Army CM/CCM Center.

TITLE: COMMANDER V - Tactical Air/Land/Naval Operations Model

MODEL TYPE: Analysis.

PROPONENT: Science Applications International Corporation (SAIC), 400 Franklin Road, Suite 200, Marietta, Georgia 30067.

POINT OF CONTACT: Mr. Jeffrey D. Wise, (404) 426-7774.

PURPOSE: COMMANDER V is a balanced air/land/naval battle simulation that is primarily used to evaluate weapons system effectiveness and sensitivities, weapon system employment concepts, force mix effectiveness, and force employment strategies.

DESCRIPTION:

Domain: Air, land, and naval operations.

Span: Typically multiple BLUE corps engaging multiple RED armies. Central European and Southwest Asia data bases have been completed.

Environment: Terrain is gridded with direction-dependent movement degradation and capacities input for both wheeled and tracked vehicles. Natural and man-made obstructions are explicitly modeled including rivers and minefields. Models day and night operations and localized and transient weather effects.

Force Composition: BLUE, RED, joint, and combined forces.

Scope of Conflict: Primarily conventional warfare.

Mission Area: Ground operations include armor, infantry, artillery, army aviation, combat support and combat service support. Air operations include CAS, BAI, AI, OCA, DCA, airlift, AGACS, and reconnaissance. Naval operations include surface, air, aircraft carrier, amphibious and sealift.

Level of Detail of Processes and Entities: Ground units can be modeled to the squad level but more typically are aggregated at the battalion or brigade level for large scenarios. Aircraft are typically handled individually or grouped into flights of four homogeneous aircraft. Naval assets are tracked individually. Ground unit attrition is accomplished using a weapon/target specific methodology that accounts for ground vehicles sensor capabilities, lethality, and vulnerability. Air defense simulation includes netted target acquisitions, Tel allocation, missile and equipment availability checks, and Monte Carlo damage/kill assessments. Naval attrition is evaluated using Monte Carlo draws after the individual target has been detected and engaged. Air/land/naval C3I including reconnaissance and intelligence asset management, intelligence fusion, communications network, and C2 centers are explicitly modeled. Air/land/naval logistics including consumption and resupply of munitions, POL, and general supplies are also explicitly modeled.

CONSTRUCTION:

Human Participation: Required for gaming decisions. COMMANDER V simplifies this process by being totally menu-driven and providing a series of battle management displays such as computer-generated color terrain maps, available

asset lists, and situation reports. Courses of action are nominated for the gamers.

Time Processing: Dynamic, time-step, and event-step.

Treatment of Randomness: Sensor performance and kill evaluations for air and naval combatants are handled stochastically after calculations of these probabilities are made. Land attrition is treated deterministically.

Sidedness: Two sided, symmetric.

LIMITATIONS: Not currently configured to model political and psychological warfare or the effects of chemical and nuclear weapons.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Work is under way to improve sensor and electronic countermeasure capabilities.

INPUT: Required data for weapon systems includes sensor capabilities, lethality, vulnerability, mobility, logistical requirements, repairability, and sustainability. Force structures must be assembled, C3 relationships must be established, and environmental data such as terrain and weather conditions must be entered.

OUTPUT: Complete time history with summaries for major mission areas such as air strike results, air defense effectiveness, and ground unit movement and attrition. Graphical results such as FLOT traces are also available.

HARDWARE AND SOFTWARE:

Computer:	Currently running on VAX series with VMS.
Storage:	2 MB main memory on VAX, 50 MB storage for data base.
Peripherals:	Ramtak or Tektronix graphics device and line printer.
Language:	SIMSCRIPT II.5, FORTRAN.
Documentation:	Documentation update in progress.

SECURITY CLASSIFICATION: Model source code is unclassified.

GENERAL DATA:

Date Implemented: 1989

Data Base: Preparation time is typically 2 to 6 man-months.

CPU time per Cycle: Approximately 2 hours of CPU per day of battle.

Data Output Analysis: Postprocessor is available to sort through output file and generate summary statistics.

Frequency of Use: In almost continual use and development.

Users: Used primarily by SAIC in support of a variety of commercial and government customers.

Comments: N/A.

TITLE: COMO III - Air Defense Computer Modeling System

MODEL TYPE: Analysis.

PROPONENT: Systems Analysis and Evaluation Office, U.S. Army Missile Command, Redstone Arsenal, AL 35898-5060.

POINT OF CONTACT: Charles E. Colvin, (205) 876-1333, AV 746-1333.

PURPOSE: COMO III is a general-purpose critical event modeling system designed for the writing and development of air defense simulations. It is used to evaluate the operational effectiveness of air defense weapon systems in a realistic tactical scenario. COMO III is used as a research and development tool and an operations support tool.

DESCRIPTION:

Domain: Land and air.

Span: Theater, corps, division, battalion, individual fire unit.

Environment: Electronic battlefield, digitized terrain, meteorological visibility.

Force Composition: Mix of land-based air defense weapon systems and mix of attacking airborne threat and tactical missiles.

Scope of Conflict: Conventional.

Mission Area: All conventional missions of an attacking airborne threat and tactical missiles.

Level of Detail of Processes and Entities: Single aircraft, tactical missile or air defense fire unit.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Event-step with some time-step events.

Treatment of Randomness: Stochastic using both direct and Monte Carlo computation.

Sidedness: Two-sided, asymmetric with one side nonreactive.

LIMITATIONS: Initial setup of game requires large number of labor hours, excessive CPU hours for large-scale scenario, reactive and smart ECM not played, and wild-weasel tactics not simulated for aircraft.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Real-time battlefield graphics display package.

INPUT: Tactical scenario, weapon characteristics, ECM, weather effects, fire unit deployment, firing doctrine, rules of engagement, and defended ground assets.

OUTPUT: Computer printouts, plots, raw data, event-by-event summary, multiple replication statistics, and kill summaries.

HARDWARE AND SOFTWARE:

Computer:	CDC 7000 series, CYBER 74, VAX 11/700 series, DEC MicroVAX, DEC 8000 series, GOULD, HP 9000, UNIVAC.
Storage:	160 K octal for nonvirtual memory computer.
Peripherals:	1 VT100 terminal and 1 high-speed printer.
Language:	FORTRAN 77.
Documentation:	Fully documented.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Minimum 0.5 man-year, maximum 6 man-years.

CPU time per Cycle: Variable.

Data Output Analysis: Variable depending on level of expertise of analysts.

Frequency of Use: Continuously.

Users: TRADOC, MICOM, CAA, AMSAA, USA MSIC, numerous contractors.

Comments: COMO III is managed by the MICOM COMO Model Management Board.

TITLE: COMO ADC3 COMO Air Defense C3 Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Missile and Space Intelligence Center, Redstone Arsenal, AL 35898-5500.

POINT OF CONTACT: Donald P. Shepherd, (205) 876 5626; AV 746-5626, Francis Cline, (205) 876-4934; AV 746 4934.

PURPOSE: The COMO ADC3 model is a critical event, general purpose, Monte Carlo combat model for force-on-force simulation of air and ground warfare. The model realistically portrays the C3 functions as encountered in combat, such as loss of C3 nodes, errors in communications, and errors in target handover between the acquisition and tracking radars. The model has a side range of applications, such as a system effectiveness, mission planning, employment and deployment, force structure evaluations, firing doctrine development, battle management algorithm development, and evolutionary concept evaluation. The model simulates two-sided combat in war games ranging in complexity from one-on-one to many-on-many. Although developed mainly for evaluation of RED Air Defense Systems, the ADC3 model can use any weapon deck (RED or BLUE) developed for COMO.

DESCRIPTION:

Domain: Land, air, and sea.

Span: Accommodates any theater where Defense Mapping Agency data is available.

Environment: System limitations determined by local terrain and environmental factors, such as weather and vegetation.

Force Composition: Joint and combined forces, RED and BLUE.

Scope of Conflict: Primarily conventional warfare.

Mission Area: All conventional warfare.

Level of Detail of Processes and Entities: Can be played at three levels of detail depending on resolution of weapon decks. Level 1: processes and functions combined with cumulative results modeled. Level 2: detailed process and functions modeled. Level 3: detailed processes and functions modeled down to component level. MSIC model is at Level 2. All data does not have to be at the same level. All statics are Monte Carlo based. Any measure of effectiveness can be output down to individual units.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric, reactive model.

LIMITATIONS: Could be used to model sea warfare but has not been modeled to do so in present configuration.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Model enhancements continuing in pre- and postprocessors, weapon models (new RED weapon decks developed as systems data becomes available), air-to-air combat, and IFF and terrain modeling.

INPUT: Scenario (weapon system positions, etc.) and weapon system characteristics.

OUTPUT: Printouts or disk storage data can be analyzed from a terminal with a postprocessor.

HARDWARE AND SOFTWARE:
Computer: Any computer with an ANSI FORTRAN compiler.
Storage: 7 to 10 megabytes.
Peripherals: 1 printer.
Language: FORTRAN 77.
Documentation: Four published manuals.

SECURITY CLASSIFICATION: Unclassified, but data base is classified.

GENERAL DATA:
Date Implemented: N/A.

Data Base: Data base on RED Systems maintained at MSIC.

CPU time per Cycle: Dependent on scenario size (number of combat units in game).

Data Output Analysis: Postprocessor used for data analysis; hard copy available.

Frequency of Use: Model in continual use for model enhancement, weapon deck development, and air defense studies.

Users: MSIC.

Comments: The MSIC COMO ADC3 model is unique in that it deals with air defense from the RED perspective but is totally compatible with all BLUE COMO models. The COMO frame is managed through a configuration control board made up of representatives of all users (government and contractor). All modifications and upgrades are reported through user group meetings. Therefore, all COMO models and weapon decks (RED and BLUE) are compatible and available to all users.

TITLE: COMO(T) - Computer Model

MODEL TYPE: Analysis.

PROPONENT: USAADASCH, ATTN ATSA-CSD-CM, Ft Bliss, TX 79916-0002

POINT OF CONTACT: Mr. Tom Crow, AV 978-2304.

PURPOSE: COMO is used primarily for air defense systems effectiveness analysis, but may be used to perform analysis in the areas of systems development, mix, doctrine, deployment, and employment.

DESCRIPTION:

Domain: Land and air with limited naval application.

Span: May represent from individual to theater.

Environment: Terrain relief, weather, time of day, electronic countermeasures, and IR countermeasures are available for selection by the user.

Force Composition: Component, RED and BLUE.

Scope of Conflict: Primarily conventional, but some nuclear and chemical warfare effects possible.

Mission Area: Air defense.

Level of Detail of Processes and Entities: Entities are typically modeled to the individual fire unit or platform level. The subsystems which compose the fire unit are simulated in great detail. For example, the functions of air defense systems are simulated for search, detection, track, engagement decision, launch, fly-out, burst, and kill assessment.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic, time-step and event-step model.

Treatment of Randomness: Stochastic with Monte Carlo draws.

Sidedness: Two-sided, symmetrical.

LIMITATIONS: Allows for only 4096 players concurrently in the simulation.

PLANNED IMPROVEMENTS AND MODIFICATIONS: COMO is currently undergoing a total redesign to allow for a user-friendly environment in the areas of weapon system simulation and scenario data base generation.

INPUT: Terrain, weapons, movement, performance characteristics, static locations, ECM, IRCM, weather, time of day, and number of players.

OUTPUT: Computer printouts, plots, and raw data to drive post execution graphics. Postprocessor available.

HARDWARE AND SOFTWARE:

Computer: Any 32 BIT computer.
Storage: 3.5 MB.
Peripherals: Minimum requirements: 1 printer, 1 terminal.
Language: FORTRAN
Documentation: Extensively documented in numerous published manuals.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Depending on scale and level of detail desired, development can vary from man-hours to man-weeks.

CPU time per Cycle: Dependent upon data base sizes and systems being modeled.

Data Output Analysis: Postprocessing aids in analysis of output data.

Frequency of Use: In constant use by most users.

Users: USAADASCH, USA TRADOC, USAAMC, USAMICOM, CALL STC, AND USAMSIC.

Comments: Managed through a modeling resources group.

TITLE: ConMod - Conflict Model

MODEL TYPE: Analysis and training.

PROPONENT: Conflict Simulation Laboratory, Lawrence Livermore National Laboratory, P.O. Box 808 L-315, Livermore, CA 94550.

POINT OF CONTACT: John J. Rhodes, ConMod Project Leader, (415) 422-6550, FTS 532-6550 or Dr. Ralph M. Toms, Developments Project Manager, (415) 423-9828, FTS 543-9828.

PURPOSE: ConMod is a research and evaluation tool that can deal with weapons systems development or effectiveness and force capability and requirements and combat developments. ConMod is designed to support training for team skills development and to serve as an exercise driver at all levels from the small units to the Corps.

DESCRIPTION:

Domain: Land and air assets. The simulation is data base-driven so that the user can change data to emulate systems that are not explicitly modeled without recompilation.

Span: ConMod simulates force sizes from small units to Corps level at item-level resolution.

Environment: Digitized terrain from DMA or other data bases for elevation with cultural features overlay. Roads and rivers are explicitly modeled. Model allows for daytime and limited nighttime play. Weather is can be changed but remains constant during the simulation.

Force Composition: Joint and combined forces, RED and BLUE.

Scope of Conflict: Conventional, advanced conventional, beam and nuclear weapons, and limited chemical effects.

Mission Area: All conventional and nuclear land operations.

Level of Detail of Processes and Entities: It is designed to support automated command and control of tactical units. Movement plans are automatically generated but can be reviewed and altered interactively by an analyst. Acquisition is performed at the unit level, but attrition occurs at the item system level. Attrition is stochastic: direct fire attrition is item system against item system, while indirect fire attrition is by individual artillery round against item systems.

CONSTRUCTION:

Human Participation: Designed to be used with varying levels of human participation from nearly fully automatic (little human participation) to intensive human interaction.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic.

Sidedness: Two-sided, asymmetric.

LIMITATIONS: Phased development restricts functionality as function of calendar year.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Phased development.

INPUT: Terrain file, pH/pK file, user-defined symbol file, and scenario file. Scenario file contains all system and unit characteristics. User can change model data.

OUTPUT: Real-time graphical, interactive graphics-aided postprocessing, and printed output.

HARDWARE AND SOFTWARE:

Computer:	Although ConMod is compatible with any of the family of DEC VAX computers, at least a VAX 8800 is recommended. Uses the VMS 5.0 operating system.
Storage:	Minimum requirement: 100,000 disk blocks. Typical configuration will require 300,000 to 500,000 disk blocks. Includes both executable programs and a minimal set of data files. Large scenarios and large output files on the order of 100,000 blocks.
Peripherals:	Minimum requirement: one Tektronix 4225 workstation (minimum of two for 2-sided interactive play) with one graph tablet and one VT100 or compatible terminal. Can expand up to eight workstations with two graph tablets each. Printer not required but very useful.
Language:	VAX Ada.
Documentation:	Design documentation and user's manual.

SECURITY CLASSIFICATION: Code is unclassified code but data bases may be classified.

GENERAL DATA:

Date Implemented: In development, Beta test version available FY89.

Data Base: Creation of new data bases may take from one man-day up to several man-months depending on size and complexity.

CPU time per Cycle: Depends on scenario.

Data Output Analysis: The user determines which data is to be output to disk. Some reports can be printed, but the rest are read into files for processing through the INGRES data base management system on a graphics-based postprocessing system.

Frequency of Use: Will vary by installation.

Users: Lawrence Livermore National Laboratory, U.S. Army.

Comments: ConMod is a multi year program with phased operation capabilities.

TITLE: CORBAN - Corps Battle Analyzer

MODEL TYPE: Analysis (potential for FTX driver).

PROPONENT: U.S. Army TRADOC, FLVN, Ft Leavenworth, KS 66027-5200

POINT OF CONTACT: BDM Corporation: Earl Williamson, (703) 848-6327.

PURPOSE: CORBAN was developed explicitly to add the elements of doctrine, maneuver, and the attack of rear areas to the analysis of corps-level battle. It is a research and evaluation tool suitable for assessing overall weapon system effectiveness (as opposed to performance) as well as doctrine and operational/tactical issues.

DESCRIPTION:

Domain: Land with air support missions.

Span: Corps-sized area: 3.5 km hexagonal terrain blocks.

Environment: Hex-based. Forestation, urbanization, roads, and rivers.

Force Composition: Treat all elements of corps AirLand Battle.

Scope of Conflict: Conventional, chemical, and nuclear warfare. Asymmetric battle; maneuver breakthrough and attack of fire support and service support explicitly treated.

Mission Area: AirLand Battle doctrinal defense of a corps area.

Level of Detail of Processes and Entities: CORBAN treats units down to detachment level although most units are treated as battalion or batteries. Terrain is represented by 3.5 km diameter hexes. Each processing cycle, each entity reloads its target array through the unit-on-unit detection logic. It then re-evaluates its mission based on the force ratio within its detection perimeter. Based on the template-level orders with the BLUE or RED doctrine file, the unit will decide if it must alter its mission or make request to its superiors. The decision to alter a unit's mission or to request fire support or supplies is communicated subject to delays imposed by unit-level suppression and jamming. The entity will fire on enemy units one weapon-target combination at a time, allocating fire according to a mixture of target value and target opportunity. If the mission requires movement, the entity will move in increments of 250 meters toward its objective at the highest speed allowed by the operation and the terrain. Entities may be lower than battalion for special units, and the time-step is variable.

CONSTRUCTION:

Human Participation: A set of orders must be prepared in advance to govern the actions of both sides. These orders are similar to real orders in that they contain the mission, objective, attachment, and priorities for fire support and resupply. If necessary, additional orders can be entered at one of the scheduled break points in the simulation.

Time Processing: Dynamic, time-step. There may be different levels of time-step for attrition, battalion decisions, brigade and regiment decisions, etc.

Treatment of Randomness: A small subset of model actions are random, most significantly the stochastic detection of one entity by another. Attrition is deterministic.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Because there is no terrain elevation, line of sight from hex-to-hex (3.5 km) is probabalistic. Weapon types are counted in fractional units but are positioned in groups. For example, each tank does not necessarily have a unique position.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Some range dependency for attrition and detection at the weapon level, and some terrain and activity dependence in unit-on unit detection.

INPUT: Terrain data, weapon fire control capabilities characteristics, unit detection capabilities, basic doctrine, and reactions of battalion and brigade/regiment-sized units, order of battle, and orders for major units.

OUTPUT: Killer-victim scoreboards, unit positions, strength, missions, and an "audit trail" of unit decisions.

HARDWARE AND SOFTWARE:

Computer:	Micro-Vax.
Storage:	10-20 MB for data.
Peripherals:	Printer, terminal, and plotter.
Language:	FORTRAN with the MIDAS preprocessor.
Documentation:	Latest documentation is April 1986.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1983.

Data Base: Preparation of a new scenario takes two to four man-months given an existing terrain data base, doctrinal unit actions, and reactions data base.

CPU time per Cycle: For a typical scenario, the model runs more than five hours of combat for one hour of Micro-Vax time.

Data Output Analysis: A postprocessor produces briefing material.

Frequency of Use: See below.

Users: The Tactical Systems Analysis Directorate of BDM Inc. in McLean, VA, runs the model 12-20 times per year for the Defense Nuclear Agency, the U.S. Army, and the other customers. The model is also in use at other BDM offices, at the Training and Doctrine Command, and with major deployed forces in Europe and Korea.

Comments: N/A.

TITLE: Correlation of Forces Model

MODEL TYPE: Analysis.

PROPONENT: Soviet Analysis Section, Ground/Frontal Forces Branch, DIA.
ATTN: DB-1B3, WASH DC. 20340

POINT OF CONTACT: Mr. Jeffrey D. Mazero, (202) 373-4069, AV 243-4069.

PURPOSE: The model allows the comparison of RED and BLUE ground and air forces in terms of combat potential.

DESCRIPTION:

Domain: Ground and air.

Span: Theater, regional, local (to division level).

Environment: N/A.

Force Composition: Combined ground forces; air forces.

Scope of Conflict: Conventional and nuclear.

Mission Area: N/A.

Level of Detail of Processes and Entities: Entities: Air force squadrons, ground force regiments/brigades, divisions. Processes: The model compiles combat potential points for each unit, aggregates the total, and develops a force-to-force ratio.

CONSTRUCTION:

Human Participation: Required for scenario setup.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: Unknown.

LIMITATIONS: The model is not dynamic.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Force projections for RED and BLUE 1995 tables of organization and equipment.

INPUT: Scenario.

OUTPUT: Printout.

HARDWARE AND SOFTWARE:

Computer:	Zenith 386.
Storage:	2 MB of RAM, 40 MB physical storage hard drive.
Peripherals:	Printer and EGA monitor.
Language:	Clipper DBase 3 dialect.
Documentation:	In-house documentation only.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: 1988.

Data Base: DIA data base and data questionnaires.

CPU time per Cycle: Scenario dependent.

Data Output Analysis: Scenario dependent.

Frequency of Use: Varies.

Users: DB-1B3.

Comments: N/A.

TITLE: COSAGE V - Combat Sample Generator

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, 8120 Woodmont Ave, Bethesda, MD 20814

POINT OF CONTACT: Mr. John Warren, (301) 295-1690, AV 295-1690.

PURPOSE: COSAGE is a computerized combat assessment/weapons effectiveness model that develops information on ammunition expenditures and losses of personnel and equipment during 24- to 48-hour period of combat. The principal application is the forecasting of personnel, ammunition, and equipment requirements.

DESCRIPTION:

Domain: Land and air.

Span: Division area of operations.

Environment: When terrain parameters are required, the model randomly selects a terrain type based on statistical analysis of the region of interest. These parameters are then used to determine line of sight, movement rates, etc. Night and day are modeled, and visibility varies by time of day.

Force Composition: Combined arms army, including helicopters and close air support.

Scope of Conflict: Conventional warfare.

Mission Area: Most of the mission areas associated with conventional combined arms are represented, with the exceptions of logistics and intelligence.

Level of Detail of Processes and Entities: Maneuver unit resolution is typically down to BLUE platoons and RED companies. In the case of close combat, resolution is to the level of individual equipment or personnel and their weapons, with each direct fire shot modeled explicitly.

CONSTRUCTION:

Human Participation: None.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Electronic, biological, chemical, and nuclear warfare are not modeled, nor military operations in built-up areas. Logistics and intelligence functions are not represented.

PLANNED IMPROVEMENTS AND MODIFICATIONS: No major improvements are planned.

INPUT: Unit organisations, strength, and weapons; orders for each maneuver unit; weapons data (single shot probability of kill, lethal area); sensor capabilities; terrain parameters; movement rates; artillery organisation and characteristics.

OUTPUT: Killer-victim scoreboard, personnel losses, ammunition expenditures by shooter/target combination, materiel losses, and unit locations on plot by time.

HARDWARE AND SOFTWARE:

Computer:	UNISYS 1100 series, with Exec 8.
Storage:	420K words of memory for model and data.
Peripherals:	Line printer; CALCOMP plotter, if plots are desired.
Language:	SIMSCRIPT II.5.
Documentation:	Combat Sample Generator User's Manual, DTIC B0770095L and Combat Sample Generator Program Maintenance Manual, DTIC B07301L.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1980.

Data Base: Six man-months required to acquire data, plus three man-months required to structure datta in model input form.

CPU time per Cycle: 90 minutes.

Data Output Analysis: One month.

Frequency of Use: Support for three to five studies per year.

Users: U.S. Army Concepts Analysis Agency.

Comments: COSAGE is linked to the following models: FORCEM (Force Evaluation Model), CEM (Concepts Evaluation Model), WARF (Wartime Replacement Factors), WARS (Wartime Ammunition Rates System), and NUFAM (Nuclear Fire Planning and Assessment Model).

TITLE: COSYCAT - Combat System Capability Evaluation Tool

MODEL TYPE: Analysis.

PROPONENT: Vitro Corporation, 14000 Georgia Ave., Silver Spring, MD 20906.

POINT OF CONTACT: A. J. Ondrish, (301) 231-2097.

PURPOSE: This STANDARD Missile (SM) Weapon System analysis tool was designed to help engineers and analysts perform parametric studies of the capabilities of the system.

DESCRIPTION:

Domain: Sea.

Span: Local area.

Environment: At sea; any time; weather not considered.

Force Composition: One ship with SM.

Scope of Conflict: Conventional warfare.

Mission Area: AAW.

Level of Detail of Processes and Entities: This model consists of interactive graphics and associated weapon system modeling programs resident in a desktop computer. Modeling and program inputs include target and ship weapon system characteristics, including the following: reaction time distributions for radar assignment, acquisition, release, and redesignation; weapon direction system engageability algorithms based on Vitro's SM simulations; threat data including target flight trajectory such as radar cross section, height, speed, dive angle, aerodynamic slowdown, FCS and search radar range and envelope limits, and FCS range rate limit.

CONSTRUCTION:

Human Participation: Required to run interactive graphics.

Time Processing: Dynamic, time- and event-step.

Treatment of Randomness: Algorithms include consideration of results of many Monte Carlo runs of SM trajectory.

Sidedness: Two-sided, SM and target (aircraft or missile).

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Target and SM system characteristics.

OUTPUT: Graphical and tabular output indicating capabilities of the TOTAL STANDARD MISSILE Weapon System.

HARDWARE AND SOFTWARE:
Computer: HP 9845C.
Storage: N/A.
Peripherals: Printer.
Language: HP Basic.
Documentation: Notes.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1987.

Data Base: Has 2000 lines of code in model.

CPU time per Cycle: Four minutes or less.

Data Output Analysis: Hard copy and graphics.

Frequency of Use: Occasionally.

Users: Vitro uses COSYCAT in support of NAVSEA for firing guidance (TARTAR SM).

Comments: For parametric studies, the characteristics of other missile systems and targets are easily modeled into the program.

TITLE: **CRASOF** Combat Rescue and Special Operations Forces

MODEL TYPE: Analysis.

PROPONENT: CINCMAC Analysis Group, HQ MAC/AG, Scott AFB, IL 62225.

POINT OF CONTACT: Capt Dan Briand, (618) 256-3450, AV 5776-3450.

PURPOSE: The CRASOF model examines the air assets necessary to conduct SOF and combat rescue missions. The model was developed to estimate the relative capabilities of a force under various strategies in order to maximize its capability.

DESCRIPTION:

Domain: Land and air.

Span: Best suited for global, theater, or regional conflicts.

Environment: Models virtually any type of SOF or rescue aircraft and selects the best available aircraft for the mission. Also models utilization and attrition rates, threat capabilities, combat radii, weather limitations, day or night operations, and air refueling.

Force Composition: Any combination of air refueling and airlift assets.

Scope of Conflict: Primarily suited for large conventional wars such as the Defense Guidance planning scenario but can be applied to any level of conflict.

Mission Area: Aircraft conduct missions into three different threat levels (high, medium, low) and three major areas of the air battle (DCA, CAS, OCA/AI).

Level of Detail of Processes and Entities: Individual aircraft grouped in minimum unit sizes are located at specific geographical coordinates. Individual downed aircrews and insertion/extraction/resupply locations for SOF teams are chosen randomly by latitude and longitude in areas of the air battle. The closest capable aircraft available to accomplish a mission is selected and air refueling requirements are then computed. Aircraft attrition rates are randomly applied against each mission and additional rescues are initiated for any attrited rescue or SOF airlift asset.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step model.

Treatment of Randomness: Aircraft availability and ute rate reductions, mission objective locations and effectiveness, tanker attrition, mechanical aborts, and weather delays are some of the stochastically modeled events. Mission arrivals are deterministic.

Sidedness: One-sided.

LIMITATIONS: None.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Input files require geographical coordinates of air battle areas, aircraft bed-downs, aircraft capabilities, force sise and locations of SOF, and rescue air assets. The number of SOF and rescue missions required by day or phase of conflict must also be input.

OUTPUT: A comprehensive report of all mission activities for a specified number of replications of the conflict.

HARDWARE AND SOFTWARE:

Computer:	Concurrent 3260 with OS32 operating system.
Storage:	Minimum of 232K.
Peripherals:	1 printer.
Language:	FORTRAN 77.
Documentation:	Substantial documentation including user's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: N/A.

Time Requirements:

Data Base: Basic scenario setup takes several man-days. Minor variations require several man-hours.

CPU time per Cycle: Varies. Minutes to hours of CPU time depending upon the length of conflict and number of aircraft, missions, theaters, and replications.

Data Output Analysis: Report shows statistics for each mission area (infil, exfil, etc.) and for each type of aircraft in theater. The daily minimum, maximum, mean, and total observations are shown as well as the standard deviation for each statistic.

Frequency of Use: Used frequently to answer questions on SOF and rescue capability.

Users: MAC.

Comments: None.

TITLE: CRUISE Missiles - C-Based Routines for Understanding Interaction Between Ships, EW, and Missiles

MODEL TYPE: Analysis.

PROPONENT: Naval Research Laboratory, Tactical Electronic Warfare Division, Code 5750, Washington, DC 20375.

POINT OF CONTACT: Dr. Gerald E. Friedman, (202) 767-3337.

PURPOSE: The CRUISE_Missiles model is used primarily to measure the effectiveness of various EW techniques against existing and postulated RF antiship missiles.

DESCRIPTION:

Domain: Naval antiship missile defense scenarios.

Span: Considers the terminal defense region local to the ships.

Environment: Detailed model of multi-path and clutter based on sea state.

Force Composition: Generally used with a ship, onboard ECM, one or more decoys, and one or more RF-guided antiship missiles.

Scope of Conflict: RF-guided antiship missiles (SS-N and AS).

Mission Area: Terminal defense against RF antiship missiles.

Level of Detail of Processes and Entities: Models missiles at the subsystem level using differential equations that represent in complete detail subsystems such as airframe, autopilot, RF seeker, and signal processing. The radar return for each pulse retains the intrapulse details. Ship and chaff targets are represented as range-distributed, statistically fluctuating radar cross sections. Active EW systems are also modeled. Missiles, ships, chaff, and countermeasures interact on pulse-by-pulse basis.

CONSTRUCTION:

Human Participation: Required for setting up the engagement scenario and initiating the simulation.

Time Processing: Event-driven mechanism. The events are transmit pulses of missiles. Dynamic equations representing the various subsystems are numerically integrated using the Euler method, with the interevent duration as the time step.

Treatment of Randomness: Stochastic. There is provision for repeating a number of missile attacks and for performing a Monte Carlo analysis.

Sidedness: Two-sided, symmetric model with threats interrogating targets using RF pulses and targets responding with a radar return signal. The model represents threats (antiship missiles) against targets (ship, chaff, and ECM).

LIMITATIONS: The collection of threat and target models is not comprehensive. Simulation execution speed does not currently support real-time operation.

PLANNED IMPROVEMENTS AND MODIFICATIONS: New missile airframes and signal processing techniques are being added. Spatially distributed ship models with traceability to ship structures are being developed. Execution speed is being improved by porting model to a mini-supercomputer.

INPUT: Consists of missiles and targets that make up an engagement scenario. The missiles and targets are, in turn, specified by their component subsystems, which can be mixed and matched to form new entities.

OUTPUT: The user can select crucial variables in the missile and target subsystems and display them in x-y plots. A two-dimensional representation of the scenario showing the evolving location of targets, missiles, and their range gates is also available. Results of Monte Carlo are automatically saved to disk files for later analysis.

HARDWARE AND SOFTWARE:

Computer:	DEC VAX computer with VMS. Planned additional availability under UNIX on a mini-supercomputer.
Storage:	6 MB of disk storage for source files and data.
Peripherals:	Tektronix 4014 graphics terminal or equivalent.
Language:	"C" and FORTRAN.
Documentation:	Draft copy of an NRL Report describing the model.

SECURITY CLASSIFICATION: SECRET, although some parts are unclassified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Model does not use a data base, but preparing detailed subsystems for a new missile may take several months.

CPU Time per Cycle: On a DEC VAX/VMS system, the model takes one minute to simulate one second of a missile-ship engagement.

Data Output Analysis: Monte Carlo runs automatically generate formatted report. Other runs produce hard copy of graphics display.

Frequency of Use: Used daily at NRL Code 5750.

Users: NRL Code 5750 uses entire model; other groups including NRL, NSWC, PMTC, NAVAIR, and NWC use major subsystems.

Comments: CRUISE_Missiles is being incorporated as major constituent in a multi-sided, multi-reactive Naval theater warfare simulation facility being established at NRL.

TITLE: CVOF - Ceiling and Visibility Observation/Forecast

MODEL TYPE: Analysis.

PROPONENT: USAFTAC/DNY, Scott AFB, IL 62225-5438.

POINT OF CONTACT: Capt. David J. Ulsh, (618) 256-5412; AV 576-5412.

PURPOSE: CVOF generates synthetic observation and forecast of ceiling and visibility at multiple locations. It preserves the unconditional probabilities of occurrence of ceiling and visibility, as well as the temporal, spatial and cross-variable correlations. The simulator is tuned to a particular geographic area by inputting modeling coefficients and correlation parameters that were specifically determined from observed weather data from that area. CVOF is designed to be a resident weather simulator within larger host simulation models.

DESCRIPTION:
Domain: Surface weather observations and forecasts. Program produces ceiling visibility values.

Span: Global. The model accomodates any theater as long as there is sufficient raw cloud cover data.

Environment: Provides weather data for 24-hour applications. Weather data consists of simulated values of observations and forecasts for ceiling and visibility.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: CVOF produces ceiling and visibility values at surface stations. Geographical influences are built into the modeling coefficients.

CONSTRUCTION:
Human Participation: None.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: Data only at stations with coefficients; limited to 200 stations of data in a particular month.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Recode in SIMSCRIPT II.

INPUT: Modeled parameters for ceiling and visibility, cross-variable correlation, and serial correlation.

OUTPUT: Ceiling and visibility values both observed and forecast for each station for every time step.

HARDWARE AND SOFTWARE:

Computer:	Amdahl 470V8 with MVS/SP operating system.
Storage:	The program and input data for 15 stations requires 300 KB of disk storage. The program requires 3.5 megabytes of run-time core memory.
Peripherals:	Printer recommended but not required.
Language:	FORTRAN 77.
Documentation:	Fully documented source code with an analyst's manual and programmer's manual.

SECURITY CLASSIFICATION: Unclassified; however, this program contains critical technology releasable to DOD and its contractors.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Requires approximately 3 man-weeks to prepare a data base of 20 stations.

CPU time per Cycle: Depends on the number of sites selected. For a single site, 4 X 10 -3 seconds; for 15 sites with a 1000 day simulation, approximately 4 minutes.

Data Output Analysis: The program has many diagnostic routines that are optional. Output consists of statistical tabulations.

Frequency of Use: Unknown.

Users: AFCSA, USAF/SAGW, Pentagon, Room 1D380B, Washington, DC.

Comments: None.

TITLE: CWASAR Cruise Weapon Analysis Simulation and Research

MODEL TYPE: Analysis.

PROPONENT: McDonnell Douglas Missile Systems Company, P.O. Box 516, St. Louis, MO 63166.

POINT OF CONTACT: John Fox, (314) 233-0663.

PURPOSE: CWASAR models a BLUE force of TASMs and tactical aircraft carrying air-to-ground weapons, which attack RED force ships. CWASAR analyzes the survivability and effectiveness of the BLUE force in support of engineering analyses for weapon system development, and the development of tactical doctrine, such as effectiveness of a mix of weapon systems against targets.

DESCRIPTION:

Domain: Air and sea.

Span: Theater or regional.

Environment: Any sea area.

Force Composition: BLUE force TASM cruise missiles and tactical aircraft; RED force ships with SAM and gun defensive systems.

Scope of Conflict: Conventional weapons.

Mission Area: Defense suppression and target damage.

Level of Detail of Processes and Entities: Missiles (BLUE and RED), aircraft, and air-to-surface weapons (Harpoon, HARM, bombs, Walleye) are represented individually and are modeled with three or more degrees of motion. Radar performance models include radar range equation, multipath, sea clutter, and [illegible] superstructure masking. The Tomahawk cruise missile model is the engineering tool used to develop TASM guidance and attack logic, and is the the standard simulation against which all other TASM simulations are validated. The HARM model includes all guidance and attack logic modes. Attrition stops motion. Damage to a necessary component suppresses a system. For example, the loss of a SAM radar suppresses that SAM system.

CONSTRUCTION:

Human Participation: User plans scenario and creates input files. No human interaction during a simulation run. A postsimulation graphics replay program uses a file produced during the run to display the scenario dynamically. A user can stop and restart the replay, adjust the running speed, and zoom and pan the display.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric. RED force is reactive; BLUE force is partly preplanned and partly reactive.

LIMITATIONS: Maximum of 50 cruise missiles, 50 BLUE aircraft, and 25 RED ships.

PLANNED IMPROVEMENTS AND MODIFICATIONS: RED force additions: carrier-based interceptor aircraft. Rehost to VAX/VMS.

INPUT: BLUE and RED force weapon characteristics, TASM engagement plans, BLUE aircraft flight plans, and RED ship classes and locations.

OUTPUT: Computer file outputs with target damage assessment, BLUE force attrition, RED force attrition, detailed time history of events, and graphics replay. Postsimulation graphics replay program provides dynamic color graphics display of strike area showing moving vehicles, targets, and flight plans. Statistical report program provides effectiveness and survivability information.

HARDWARE AND SOFTWARE:

Computer:	Harris 1000 or 1200 system; Harris VOS operating system.
Storage:	Approximately 5 MB of main (virtual) memory and 10 MB of disk storage, depending on level of output detail requested.
Peripherals:	Tektronix 4115 or 4125 graphics terminal.
Language:	FORTRAN 77 with Harris extensions.
Documentation:	Simulation catalog entry (15 pages), model description (96 pages), user manual (63 pages).

SECURITY CLASSIFICATION: Secret. (Nearly all code is unclassified, a small number of subprograms are secret or confidential.)

GENERAL DATA:

Date Implemented: 1983.

Data Base: Several days for a new scenario; less if working from an existing scenario.

CPU time per Cycle: Depends on scenario size. One case of 20 TASMs and 7 RED ships took 14 CPU hours for 50 Monte Carlo iterations. There are other ways in which the simulation can be run in less time for specific applications.

Data Output Analysis: Depends on the purpose of the analysis. A statistical report program is available.

Frequency of Use: Used monthly.

Users: Used in studies performed for the Cruise Missile Program Office Advanced Systems Group. McDonnell Douglas internal users include Tomahawk development, test flight planning and analysis, and Harpoon.

Comments: Utilizes radar performance data generated by SALRAM, another McDonnell Douglas simulation. Enhancements are ongoing. Simulation is certified by the Cruise Missile Program Office.

TITLE: D2PC - Downwind Chemical Hazard

MODEL TYPE: Analysis.

PROPONENT: CRDEC, Studies & Analysis Office, Aberdeen Proving Ground, MD 21010-5423.

POINT OF CONTACT: Mr. C. Glenvil Whitacre, (301) 671-4241, AV 584-4241.

PURPOSE: D2PC is used to estimate downwind hazard from chemical agent munitions. It also conducts hazard analysis of alternate operation plans and predicts hazard zones in the event of accidental release.

DESCRIPTION:

Domain: Land: flat terrain (open and woods).

Span: Local; downwind hazard extent of cloud for chemical cloud transport and diffusion.

Environment: Spectrum of expected meteorological conditions.

Force Composition: N/A.

Scope of Conflict: Chemical safety.

Mission Area: Transport and storage of chemical munitions.

Level of Detail of Processes and Entities: A modified Gaussian model is used to predict downwind hazard distances in terms of concentration and accumulated total dosage. Program considers variations in meteorology and atmospheric stability. It evaluates chemical agent spills, functioning munitions, and heated stack plumes. Stability changes are permitted from stable to less stable conditions.

CONSTRUCTION:

Human Participation: Highly user-interactive.

Time Processing: Static; total dosage estimations only.

Treatment of Randomness: Deterministic.

Sidedness: N/A.

LIMITATIONS: A rather coarse approach is used to characterize chemical cloud transport and diffusion through woods. Model lacks a technique to assess chemical cloud transport and diffusion through urban terrain. Improved assessment techniques for variable state meteorology are needed.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Automate source estimates for fire-related release situations and add a large-scale release capability.

INPUT: The program is designed to be user friendly for simulation of accidental releases that could occur at chemical storage sites. The input is selected from menus such as site location, munition type, agent type, terrain,

and meteorological parameters. The program extracts needed input parameter values from internal data base tables. Nonstandard combinations of inputs may also be defined on input.

OUTPUT: The basic output is a downwind estimate of hazard distance to "no effects," "no deaths," and "1% lethalities" based on total dosage exposure.

HARDWARE AND SOFTWARE:

Computer:	IBM-compatible PCs, UNIVAC 1100/60 system.
Storage:	Approximately 1800 lines of code.
Peripherals:	Minimum requirement: one printer.
Language:	ASCII FORTRAN (Standard FORTRAN 77).
Documentation:	User's guide, Personal Program for Chemical Hazard Prediction (D2PC), CRDEC-TR-87021, and handbook in draft form (not yet published).

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Minimal time requirements for input. Time used to answer input questions varies from several seconds to several minutes, depending on choice of available default options.

CPU time per Cycle: CPU time from one to several seconds.

Data Output Analysis: No postprocessor is available for analysis of output data. It is not, however, necessary because of the simplicity of the output.

Frequency of Use: Depending on user, it is used from many times per day to just several times per year.

Users: Broad spectrum of users through U.S. Army, U.S. Air Force, U.S. Navy, government agencies, environmental agencies, contractors, and others.

Comments: D2PC has been developed and maintained by the Studies & Analysis Office of CRDEC since 1974. Handbooks for use are available, and training classes are held from time to time upon request.

TITLE: DAP - Data Analysis Package

MODEL TYPE: Analysis.

PROPONENT: CA1 Division, RARDE, Fort Halstead, Sevenoaks, Kent, England.

POINT OF CONTACT: PO/EWS, CA1 Division, RARDE, Fort Halstead, Sevenoaks, Kent, England. Tel: Knockholt (0959) 32222 Ext 3253.

PURPOSE: DAP is a data base system designed to process the output from the Electronic Warfare Simulation (EWS).

DESCRIPTION:

Domain: Abstract.

Span: N/A.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: DAP is designed to extract data meeting user-defined criteria from the EWS data retrieval models. Data may be extracted on individual units, groups of units meeting specified criteria, and particular types of EW or communications equipment. Message histories may also be extracted via the message log processor.

CONSTRUCTION:

Human Participation: Required to interrogate the data base.

Time Processing: Static.

Treatment of Randomness: N/A.

Sidedness: N/A.

LIMITATIONS: Cannot process EW intelligence data from the EWS.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Inclusion of output from the intelligence gathering model.

INPUT: Logging files from the EWS data retrieval models.

OUTPUT: On-screen display, printout, or computer file of unit status; communications configuration; EW equipment performance with time; and computer file of unit identities and locations for input to Macintosh interactive display and analysis system (MIDAS).

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a VAX computer with VMS operating system.
Storage:	Minimum requirements: 2.5 MB main memory (12 MB ideal) and 100,000 blocks (5 MB) disk space.
Peripherals:	Minimum requirements: one VT100 terminal and one printer.
Language:	VAX FORTRAN 77, DCL, and RAPPORT DBMS.
Documentation:	User guide, system description, and programmer guides.

SECURITY CLASSIFICATION: Classified.

GENERAL DATA:

Date Implemented: November 1988.

Data Base: One-half man-day to load a new study run onto DAP.

CPU time per Cycle: Depends on data base size.

Data Output Analysis: Output file for input to MIDAS. Output files for input into Macintosh spreadsheet (EXCEL).

Frequency of Use: As required.

Users: RARDE.

Comments: N/A.

TITLE: DART Family of Survivability Models

MODEL TYPE: Analysis.

PROPONENT: Defense Nuclear Agency, Washington, DC 20305-1000.

POINT OF CONTACT: Captain Mark Loepker, SAF, (703) 325-7405.

PURPOSE: A research and evaluation tool to assess the prelaunch survivability (PLS) of nonstrategic nuclear forces and to evaluate the relative effectiveness of PLS enhancements, changes in system design, and changes in operational characteristics on the overall system PLS.

DESCRIPTION:

Domain: Land, air, or naval operations with 3 separate models.

Span: Theater, regional, or local, depending on data base.

Environment: Not explicitly addressed. Implicit impact upon operations.

Force Composition: Land-based mobile systems, dual capable aircraft (DCA) airbases, or naval forces (including submarines and surface vessels) are portrayed depending upon the model selection.

Scope of Conflict: RED and BLUE conventional, unconventional, chemical, and nuclear.

Mission Area: Assesses system's prelaunch survivability while system operates in a manner appropriate for the given tension/hostility state.

Level of Detail of Processes and Entities: For naval systems, the data base defines numbers and type of naval vessels in terms of vulnerabilities, weapons, terminal defenses, torpedo attack tactics, and SAM parameters. Aircraft carriers are further defined by there unique capabilities. Submarines are given characteristics which allow them to operate in support, on ASW missions, or independently. Maritime patrol aircraft data must also be provided. For land-based mobile systems, the BLUE forces are viewed by the threat forces as target types grouped for the purpose of movement activities. The RED threat (which comes in the form of signal intelligence, satellite and aircraft reconnaissance, agents, special operations, counterbattery artillery, and air and missile strikes) is described by threat slice, search areas, detection probabilities, and kill probabilities. The dual capable aircraft/airfield model focuses on a single airbase whose configuration is described in terms of the number of assets (aircraft and weapons), and the number of dimensions of key facilities (runways, shelters, communications, and weapon storage facilities). In addition, the aircraft and mission parameters and the airbase's associated sortie generation activities are detailed in the data base. The base is subject to RED attacks from air, missile, and ground threats which are described by threat slice and kill probabilities against the base's assets and facilities.

CONSTRUCTION:

Human Participation: Required for processes (model is interruptable).

Time Processing: Dynamic, event-step model.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, asymmetric, reactive model.

LIMITATIONS: Terrain, sea, and weather conditions must be implicit in operational data. Off-line effort may be required to create the data bases.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Follow-on contract will enhance future versions.

INPUT: A data base must define BLUE and RED forces, as well as activities both offensive and defensive associated with these forces. An entire schedule of events such as RED/BLUE deployment and engagements is user specified.

OUTPUT: The model provides a chronology of the events in both printed and graphical outputs. A simulation run produces a printout with varying degrees of detail (user specified) about BLUE and RED survivability. The graphical output provides plots of survivability of the BLUE and RED assets.

HARDWARE AND SOFTWARE:

Computer:	IBM or compatible (MS DOS).
Storage:	Hard disk or high-density drive required.
Peripherals:	Printer (laser or EPSON), EGA/CGA/XGA graphics card required for plotting.
Language:	Microsoft Quick Basic 4.0.
Documentation:	User manuals completed.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Data base development could take several weeks and require some expertise in terms of system and threat. However, variations of a data base are easily made using the models' editing programs.

CPU time per Cycle: Dependent on data base size and period of simulation. Individual simulation runs will take from 10 minutes to an hour.

Data Output Analysis: Printouts and graphics provide rapid analysis.

Frequency of Use: Varies by Command.

Users: SHAPE, AFNORTH, AFCENT, AFSOUTH, UKAIR, USEUCOM, USAFE, USAREUR, USPACOM, USPACFLT, USPACAF, WESTCOM, DNA, FC/DNA.

Comments: None.

TITLE: DEPLOY Deployment and Sustainment Model

MODEL TYPE: Training and education.

PROPONENT: War Gaming and Simulation Center, Institute for National Strategic Studies, National Defense University (NDU-NSS-WGSC) Ft. McNair, Washington, DC 20319

POINT OF CONTACT: R. D. Wright, (202) 475-1251, AV 335-1251.

PURPOSE: DEPLOY is designed to illustrate logistical constraints in deployment and employment planning. The model provides quick (less than five minutes) feasibility checks and tradeoff analyses for aggregate force deployments in support of academic exercises. Users balance theater demands with available lift, set tradeoffs between unit arrivals and stock buildups and between deployed force elements and support slices.

DESCRIPTION: The data base and model calculate lift requirements or close dates for as many as five different theaters. Force elements are described in terms of personnel, outsized and oversized/bulk unit equipment weights, support unit needs, and peacetime and wartime consumption requirements. Theater data comprises distances and prepositioned stocks and available host nation support. U.S. and allied airlift and sealift assets are shown under various mobilization options. Users provide a prioritized force list and lift allocation with supply requirements and the model calculates support slice needs and arrival dates; or users provide required arrival dates for a force units and the model calculates support elements and required lift.

Domain: Intertheater air and sea lines of communication.

Span: Theater level deployments; no intratheater movement.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Divisions, brigades, and like-size army support elements; MEFs/MEBs, squadrons and wings. Naval units are not included.

CONSTRUCTION:

Human Participation: Force unit priority, supply level, and lift allocation decisions.

Time Processing: One week time steps.

Treatment of Randomness: Deterministic.

Sidedness: One-sided. The game may include teams playing different theaters arguing about theater lift allocations.

LIMITATIONS: No CONUS transportation constraints; no intermediate air base throughput capability, no theater port capability constraints or introtheater lift. Thus, the model generates optimistic results.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Database revisions; partial treatment of CONUS, intermediate air base, and theater port constraints.

INPUT: Units to be deployed (with priorities); supply levels desired; either lift allocation to theater or required closure dates.

OUTPUT: Time Phase Force and Deployment List; theater stocks; support element balance, air (C-5 and C-141/CRAF) and sealift used.

HARDWARE AND SOFTWARE:

Computer:	An IBM-XT or Z-248/IBM-AT or clone with 512K byte memory.
Storage:	Can run from a floppy disk.
Peripherals:	Printer.
Language:	FORTRAN.
Documentation:	Exercise and user's guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1983.

Data Base: Additional theaters can be added in a day by an area-knowledgeable user.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: Four multi-team exercises per year.

Users: NDU Industrial College of the Armed Forces, National War College, and Institute for Higher Defense Education.

Comments: Source code maintained at NDU-NSS-WGSC.

TITLE: DESCEM - Dynamic Electromagnetic Systems Combat Effectiveness Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Electronic Proving Grounds, ATTN: [STEEP-(T-E)], Fort Huachuca, AZ 85613-7110.

POINT OF CONTACT: Steven C. Cooper, (602) 538-4953, AV 879-4953.

PURPOSE: As an operational support tool (decision aid), DECSEM is used to determine expected message delay as a function of link availability, expected message length, average message arrival rate, and message service discipline.

DESCRIPTION:

Domain: Land, air, limited space, and naval.

Span: Accommodates any theater depending on the data base. Can model individual equipment systems to full corps and above deployments.

Environment: Communications.

Force Composition: Joint and combined forces, BLUE, GREY, and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: DESCEM models any type of communications system defined by communications links from single links to complex deployments. Traffic loading is in terms of messages that can represent either voice or data. Based on link status conditions and message profile descriptions, the model determines expected message successes and delays in terms meaningful to the communication system user.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Statistical.

Treatment of Randomness: Portions of DESCEM are probabilistic, others are deterministic.

Sidedness: Not applicable.

LIMITATIONS: Does not model propagation; results after propagation considerations provided as input.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Study work complete for adaption of U.S. Army Communications Data Base.

INPUT: Expected message length, average message arrival rate, message service discipline, and probabilities of successful link operations.

OUTPUT: Point and interval estimates of expected message waiting and completion times, expected message delays, and probability that message waiting and delay times will exceed specified time limits.

HARDWARE AND SOFTWARE:

Computer:	CDC CYBER 180 Model 830.
Storage:	Variable; requirements can be adjusted. Minimum memory is 30,100 octal words.
Peripherals:	Disk storage.
Language:	SLACS 5 (an extended FORTRAN 77).
Documentation:	Extensively documented.

SECURITY CLASSIFICATION: Unclassified, but data bases may be classified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Dependent on analysis scope. With existing data bases, analysis requiring data modification for specific test system requires 1 to 2 months depending on system.

CPU time per Cycle: Dependent on deployment size and number of equipment to be evaluated. Corps size deployment can take 100 hours of CPU time.

Data Output Analysis: Hard copy printouts.

Frequency of Use: On demand, approximately once per year.

Users: Model is resident at USAEPG.

Comments: The model is not machine dependent. However, it takes advantage of the CDC CYBER 60-bit word for optimization of data storage and access and would require modification for other environments.

TITLE: DETCONT - Detection Contour Program

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Atmospheric Sciences Laboratory, SLCAS-AE-AE, White Sands Missile Range, NM 88002-5501.

POINT OF CONTACT: Dr. Harry J. Auvermann, (505) 678-4224, AV 258-4224.

PURPOSE: DETCONT is a research and evaluation tool that deals with combat development. In addition, it deals with competing strategies of deployment and countermeasures to battlefield lasers. The model defines the boundary (the contour) of the region on a battlefield within which a given laser can be detected by a given sensor. The signatures evaluated are the radiation scattered from the port of the laser device and from the beam by airborne particulates. The model output would primarily be used in a war game to determine which opposing units were in position to detect and call in counterfire.

DESCRIPTION:

Domain: Land.

Span: Regimental battlefield.

Environment: Flat terrain, variable visibility, variable climate, variable illumination, variable background fluctuations.

Force Composition: Front line units.

Scope of Conflict: Deployment, RED or BLUE, of laser rangefinders, designators, and weapons and deployment, RED or BLUE, of unaided observation, direct view optics, image intensifiers, and thermal viewers.

Mission Area: Suppression of battlefield use of lasers.

Level of Detail of Processes and Entities: The model calculates the position on the battlefield where an individual soldier will begin to detect the presence of a laser device with one of the sensors listed above.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Static.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: Uniform battlefield conditions.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Upgrade to EOSAEL format.

INPUT: Weather, sensor, and laser data from ASCII files.

OUTPUT: Table-of-range and off-axis-angle pairs for each combination of interacting laser and sensor.

HARDWARE AND SOFTWARE:

Computer (OS):	VAX 11/780 VMS.
Storage:	200,000 bytes.
Peripherals:	Line printer.
Language:	FORTRAN.
Documentation:	Internal, users guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Minimal time.

CPU time per Cycle: 20 seconds.

Data Output Analysis: None.

Frequency of Use: Inactive.

Users: ASL.

Comments: N/A.

TITLE: DETEC - Defense Technology Evaluation Code

MODEL TYPE: Analysis - performance evaluation and system design of the SDS architecture.

PROPONENT: Paul Merillat, SDIO, RGO/POET, 1225 Jefferson Davis Highway, Suite 300, Arlington, VA 22202, (703) 685-6640/41.

POINT OF CONTACT: Martin Marietta ISG, NTB Division, M.S. N8200, Falcon AFB, Colorado 80912-5000, (719) 380-3500.

PURPOSE: DETEC is a simulation framework and set of functional models that together provide the capability to evaluate at a system level the concepts and components for the design of an SDS. The DETEC framework provides the modularity needed to integrate functional models with a wide range of capabilities and thus model a variety of SDS architectures.

DESCRIPTION: The DETEC framework includes six components: a Manager that provides a human engineering interface for simulation setup, observation, and interaction; an Executive that provides simulation control; a Mother Nature that updates the real-world environment; an Engagement element that simulates the battle; a Data Recording element that collects data for post-run analysis and display; and a Run Time Data Base composed of state vectors that characterize the simulated objects of the battle environment. Models include assets of the SDS and threat objects generated from STAMP or AURORA and ATTACK (future).

Domain: Land, sea, and space up to geosynchronous orbit.

Span: Theater or global conflicts.

Environment: Limited environment in Release 2. In future, models will reflect both natural environments and included environments.

Force Composition: Users can select from available BLUE assets, RED assets, and the RED threat. BLUE and RED assets currently include models of all SDS Phase I elements. RED threat options include SDIO-validated and user-defined threats, ASAT attacks, and penetration aids.

Scope of Conflict: Conventional and nuclear weapons.

Mission Area: SDS.

Level of Detail of Processes and Entities: Entity: The DETEC framework accommodates functional models of varying detail. Processes: Threats are not aggregated. Sensor models output angles only. Measurements (SNR error included) and irradiances are consistent with true sensor devices.

CONSTRUCTION:

Human Participation: Not required; model interruptible. Permitted to alter process or decisions.

Time Processing: Dynamic, discrete event.

Treatment of Randomness: Stochastic, direct computation and deterministic.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Release 3 planned for February 1989.

INPUT: User must build Asset Specification and Setup Parameters Files. User may select from available RED and BLUE assets and specify parameters for each asset selected or use the DETEC defaults. Help information is available to explain parameters. Typical asset parameters include quantity, type, location, field of view, range, lethality, yield required to kill, cycle time, propagation delay, etc. Threat options include ASAT attacks and penetration aids. Setup parameters include display and Mother Nature update, times, simulation stop time, initial seed for random number generator, and data logging options. Run time input options are limited to change display update time, Mother Nature update time, and continue execution time.

OUTPUT: Separate terminal-based graphical routines provide user-specified output of analyzed data. The computing network environment provides hard copy, movie film, and microfiche of any output desired.

HARDWARE AND SOFTWARE:

Computer (OS):	Cray 2 Supercomputer, UNICOS Version 4 operating system.
Storage:	Several million words.
Peripherals:	Tektronix 4237 and 4337 Workstations and 4693D printer.
Language:	Cray FORTRAN, FORTRAN 77 with extensions.
Documentation:	NTB-237-003-11-02, DETEC Users Manual; NTB-237-003-12-02, DETEC Programmers Guide; NTB-237-003-13-02, DETEC Technical Reference Manual for Release Two; NTB-237-003-14-02, DETEC Function Description Manual for Release Two; DETEC Interface Control Document (to be released with Release 3); and others.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: Initial release at Los Alamos National Laboratory - Mar 88; Release 1 at National Test Facility (NTF), Falcon AFB, CO - Sept 88; Release 2, NTF - Dec 88; Release 3, NTF - Scheduled for Feb 89.

Data Base: Time required to build a data base may vary from hours to days.

CPU time per Cycle: Depends upon size of threat.

Data Output Analysis: Can vary from minutes to hours to days.

Frequency of Use: Daily.

Users: SDIO, NTB Integration Contractor, and Joint Project Office.

Comments: N/A.

TITLE: DEWCOM - Divisional Electronic Warfare Combat Model

MODEL TYPE: Analysis.

PROPONENT: Force Modeling Division, Computer Applications Directorate, JEWC, San Antonio, TX 78243-5000.

POINT OF CONTACT: MAJ John R. Ferguson, (512) 925-2579, AV 945-2579.

PURPOSE: DEWCOM is a research and evaluation tool that focuses on the electronic combat environment in support of tactical ground and air operations. It analyzes communications, EW, and air defense employment concepts; assesses system and force mix; examines interoperability and joint and combined warfare issues; conducts combat and support force trade-offs; and interfaces with field test excursions.

DESCRIPTION:

Domain: Land and air; limited naval operations.

Span: Accommodates scales from individual to theater.

Environment: Uses DMA DTED for terrain relief. Weather and time of day considered in play of air forces and air defense systems.

Force Composition: Mix from system to combined forces level, BLUE and RED.

Scope of Conflict: Conventional, BLUE and RED.

Mission Area: Conventional missions include tactical air and ground operations; interdiction, defense suppression, support jamming in stand-off and self-protect modes; use of RPVs in a lethal or nonlethal mode; resupply; realistic communications environment; ground and airborne EW operations; intelligence gathering and dissemination among units; and air defense networks.

Level of Detail of Processes and Entities: User describes both the friendly and threat forces including infantry, armor, artillery, EW and support units, and air forces from an individual or aggregate level. User establishes a C3 structure by creating a link and net structure. Last, user issues a set of orders with stimulus for ground movement; air task orders; communications orders; and EW orders. User can use attrition to measure effectiveness of EW on the outcome of the battle. Ground warfare and logistics modeled at low resolution; communications, EW, air warfare, and air defense at high resolution.

CONSTRUCTION:

Human Participation: Not required, but model is interruptable.

Time Processing: Dynamic, time-step and event-step.

Treatment of Randomness: Stochastic, Monte Carlo determination of air, defense, and direct and indirect fire attrition based on computation of probabilities of damage and kill. Ground attrition deterministically based on modified Lanchester equation.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: No ship-to-ship fighting, naval mine warfare, or undersea operations (but naval gun support and naval air defense systems are modeled).

PLANNED IMPROVEMENTS AND MODIFICATIONS: Air-to-air, chaff, and flare capability; more detailed postprocessor support; and enhanced graphics.

INPUT: Weapons; communications and EW equipment; units, terrain, combat, and communication organization; tactical, communication and EW orders; avionics; aircraft; corridors; air operations orders; air defense systems and organization; IR and RCS patterns; airborne jammer characteristics; RPV characteristics; SEAD data tables; and attrition tables.

OUTPUT: Formatted printouts of input data; reports on status of units, links, messages, equipment, EW operations; intelligence logs; attrition summaries; air and air defense statistics; plotter output of scaled terrain box (1:500000 or 1:250000); FLOT trace at specified time intervals; histograms of specified model activities; and graphics of unit locations during the battle.

HARDWARE AND SOFTWARE:

Computer:	DEC VAX under VMS operating system or Data General, portable to any system with a SIMSCRIPT compiler.
Storage:	100,000 blocks for a division-level scenario.
Peripherals:	Printer, VT100 terminal, CALCOMP 1044 plotter and CGS4600 graphics terminal.
Language:	SIMSCRIPT II.5.
Documentation:	Executive summary, user's manual, DEC/VAX operator's manual, programmer's manual, and instructor's manual.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:
Date Implemented: 1983.

Data Base: Usually six to nine months depending on level of complexity, but use of files developed by Users Group during scenario development can decrease time.

CPU time per Cycle: Usually one hour of CPU time for every two hours of combat in a division-level scenario. Playing air and air defense increases CPU time significantly because of high resolution.

Data Output Analysis: Quick Query Output file contains records of all simulation activities using code numbers as a key, specified by the user. Graphics postprocessors help analyze output.

Frequency of Use: Varies by command; used at least annually by those below.

Users: JEWC, JWC, Combat Developments Fort Bliss, and ARMTE White Sands.

Comments: Configuration control by JEWC with an established Users Group. Upgrades are based on priorities, funding, and consensus of the Users Group.

TITLE: DIDSIM - Defense-In-Depth Simulation

MODEL TYPE: Analysis.

PROPONENT: Strategic Defense Initiative Organization (SDIO), The Pentagon, Washington, DC 20301-7100.

POINT OF CONTACT: Joan Vickery, (714) 768-8161

PURPOSE: DIDSIM was developed as an effectiveness tool for SDIO architecture evaluations. It contains low- to medium-fidelity models of most of the weapons considered by SDIO and the battle management rules for their use. Each object in the threat is modeled.

DESCRIPTION:

Domain: Air and space.

Span: Global, regional, local, or individual, depending on data base.

Environment: Space.

Force Composition: Joint and combined forces, BLUE and RED sides.

Scope of Conflict: Nuclear and non-nuclear missiles and directed energy and nuclear particle beam weapons.

Mission Area: Strategic defense, near-term and far-term.

Level of Detail of Processes and Entities: Models each RED weapon (booster, PBV, RV) as a separate entity. Reads a threat file generated by the DIDSIM threat generator (EXOCET) to obtain individual state vectors. Objects are propagated on ballistic trajectories in space, and time-of-flight contours are used for atmospheric flight. Models each of the various weapon systems (kinetic energy weapons, ground- or space-based) and space-based directed energy weapons as individual entities. Models ground- and space-based sensors individually. All space-based entities move on Keplerean trajectories. A set of battle management rules for controlling all defense assets is contained in the simulation.

Interaction of the kinetic energy weapons is modeled as a random probability of kill. The directed energy weapon's irradiance on target is calculated as a function of geometry and accumulated until the kill fluence is achieved. Sensor field-of-view (range and angle) constraints are checked to ensure that objects have been detected, tracked, and discriminated before they can be engaged. Time delays are used to model the time line associated with these precommit functions. False alarm and leakage draws are made to model the discrimination process. Directed energy and neutral particle beam weapons can also be used as discriminators where the reaction of the device with each threat object is modeled. Models all phases of strategic attack, ASATS, boost phase, midcourse, and terminal.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic time based on event steps.

Treatment of Randomness: Discrimination, kill probability, and kill assessment probability are modeled stochastically with Monte Carlo determination of results. Detection and tracking are treated deterministically.

Sidedness: Two-sided, asymmetric, one side nonreactive. RED reaction captured by the threat generation done off-line.

LIMITATIONS: Size of battle limited only by computer resources (core and run time).

PLANNED IMPROVEMENTS AND MODIFICATIONS: Constantly being modified to handle additional architecture, rules of engagement, and weapon and sensor systems.

INPUT: Highly data base-driven. Threat is generated off-line. User must input time delays, kill probabilities, sensor and weapon parameters, numbers, locations, and orbital parameters for all entities.

OUTPUT: Output varies from high-level effectiveness data to detailed performance information on each weapon's individual engagements. Can be displayed graphically.

HARDWARE AND SOFTWARE:

Computer:	Runs on VAX, Sun, Convex, and HARRIS.
Storage:	DIDSIM is three separate simulations. The largest storage requirement is for MIDSIM (2 MB).
Peripherals:	1 printer, 1 laserjet printer, and 2-3 terminals.
Language:	FORTRAN 77.
Documentation:	User manuals.

SECURITY CLASSIFICATION: Unclassified, but threat data base can be classified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Can take extensive time to set up data base for new architectures.

CPU time per Cycle: Highly dependent on threat and architecture. Large threats take several CPU hours.

Data Output Analysis: Highly interactive postprocessor available for output analysis. In-line debug aids also available.

Frequency of Use: Used extensively by SPARTA to support SDIO architecture work.

Users: SPARTA, U.S. Army Strategic Defense Command.

Comments: DIDSIM is a family of simulations: ASATSIM, SBDEWSIM, and MIDSIM. Each can be used to generate data files for higher fidelity simulations.

TITLE: DIVLEV - AMSAA Division Level Wargame

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Materiel Systems Activity (AMSAA), Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: Tony Rouse, (301) 278-7498, AV 298-7498.

PURPOSE: DIVLEV is used primarily to evaluate the impact of system-level items in the context of division and corps levels. It has also been used to evaluate different weapon mixes and tactics.

DESCRIPTION:
Domain: Ground combat (including ground-air and air-ground).

Span: Accommodates most theaters, depending on data base. Developed primarily for Central Europe but has been modified for Middle East and Southwest Asia.

Environment: Statistical terrain is overlaid by 250-meter vegetation and urbanization grid. Weather, day/night, and natural and man-made obstacles are included.

Force Composition: Combined forces, RED and BLUE.

Scope of Conflict: Primarily conventional warfare with limited chemical effects. Virtually all conventional weapon systems are included.

Mission Area: All conventional combined arms ground and helicopter combat. Tactical aircraft are included with the exception of air-to-air combat.

Level of Detail of Processes and Entities: Unit size can vary, but for most applications BLUE forces are played at company level and RED forces at battalion level. All artillery units are played at battery level. Direct-fire attrition is based on Lanchester coefficients on an element-to-element level. Indirect-fire attrition is based on target density and lethal effects of the incoming munitions.

CONSTRUCTION:
Human Participation: Required for decisions during wargaming phase. Once a set of decisions has been developed, the model can be used as a simulation without player intervention.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Completely deterministic.

Sidedness: Two sided, asymmetric. Both sides are free to react to the tactical situation.

LIMITATIONS: Does not play air-to-air combat or nuclear warfare.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Being transferred to a Sun system. Expected modifications include the use of Sun graphics to ease the burden of tactical input and to improve output display.

INPUT: Input includes force composition, player-developed conditional orders, direct-fire weapon-target kill rates, indirect-fire lethal areas, and terrain data.

OUTPUT: Printouts of unit positions, strengths and remaining orders, and killer/victim scoreboards.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on CDC CYBER 7600 (SCOPE) and VAX 11/780 (VMS). Currently being modified to run on Sun 4/280 (UNIX).
Storage:	125K words.
Peripherals:	Disk storage.
Language:	FORTRAN V/FORTRAN 77.
Documentation:	Available from point of contact.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Acquisition - 3 man-months.
Preparation - 1 man-month.
Setup time - 5 to 6 hours player training.
Playing time - 1:8 game time to real time while wargaming.

CPU time per Cycle: 5:1 game time to computer time (on CYBER 7600).

Data Output Analysis: Concurrent with game play.

Frequency of Use: Model has not been used since 1984. While model was active, 1 to 2 games played per year (50 to 100 runs per year). Model being reactivated for use on Sun 4.

Users: U.S. Army Materiel Systems Analysis Activity.

Comments: N/A.

TITLE: DNYPSIM - Wind/Pasquill Stability Simulator

MODEL TYPE: Analysis.

PROPONENT: USAFETAC/DNY, Scott AFB, IL 62225-5438.

POINT OF CONTACT: Capt. Harold A. Elkins, (618) 256-5412; AV 576-5412.

PURPOSE: The simulator is a research and evaluation tool used to generate weather data for input into another program that determines 3-D diffusion patterns for biochemical applications. This program was developed by USAF Environmental Technical Applications Center (USAFETAC/DNY). It produces simulated observations of wind direction, speed, and Pasquill index for stations in the data set at a variety of time options. The data set contains climatological values for mean "u" and "v" wind components, standard deviations, cross correlations, and mean cloud cover.

DESCRIPTION:

Domain: Weather on the lower troposphere. Program produces surface winds and Pasquill Stability Index. Pasquill calculations require cloud cover and insolation (determined by tracking solar positions).

Span: Global if data is available to calculate wind and cloud statistics. Currently, the data base consists of 55 worldwide locations.

Environment: Simulated day and night observations that are spatially and temporally correlated.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Output given for any combination of stations in data set. Geographical, diurnal, and seasonal tendencies are built into climatological data set.

CONSTRUCTION:

Human Participation: Not required. Selected stations and time options set as initial step; model then runs uninterrupted.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: Currently only 55 stations are contained in data set (30 in one, 25 in another). Arrays currently set to these maximums.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Mean "u" and "v" wind component, standard deviation, cross correlation, mean cloud cover, and scale distance for wind and cloud cover. Scale distance is a modeling parameter determined by the wind and cloud data in an area. The data base required to run the simulator can be obtained from USAFETAC.

OUTPUT: Wind duration, speed, and Pasquill Stability are produced for desired stations, date, time, and time step. Observations are accumulated in an output file designated by the user.

HARDWARE AND SOFTWARE:

Computer:	Amdahl 470V8 with MVS/SP operating system.
Storage:	77 KB required for software and data.
Peripherals:	None required.
Language:	FORTRAN 77.
Documentation:	Fully documented source code and project report.

SECURITY CLASSIFICATION: Unclassified; however, this program contains critical technology releasable only to DOD and its contractors.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Requires approximatley one man-week to prepare a data base of 25 stations.

CPU time per Cycle: Depends on number of stations and length of simulation. Output for one station and one time step requires .14 seconds of CPU time.

Data Output Analysis: Output file contains chronological list of stations and observations. No further processing is required.

Frequency of Use: Unknown.

Users: Det 1, 2WS Wright-Patterson AFB, OH 45433.

Comments: None.

TITLE: Dunn Kempf

MODEL TYPE: Training and education.

PROPONENT: Office of the Training Simulations System Manager (TSSM), The Combined Arms Training Activity (CATA), Ft. Leavenworth, KS 66027-7000.

POINT OF CONTACT: CPT John Hughes or SFC Albert J. Malveaux, AV 552-3395/3189.

PURPOSE: Dunn Kempf is designed to train company-level leaders in planning and conducting small unit tactics.

DESCRIPTION:

Domain: Land and air.

Span: A Central European setting.

Environment: Three-dimensional European terrain in the kit. Weather and time of day are put out in the operations order.

Force Composition: Joint and combined forces, BLUE and RED Army.

Scope of Conflict: Conventional war game.

Mission Area: All conventional missions. Cannot be used for unconventional missions.

Level of Detail of Processes and Entities: The lowest level entities are platoon-size units.

CONSTRUCTION:

Human Participation: Required; 5 to 17 players and 1 to 3 controllers needed.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Dunn Kempf does not display units in wooded areas. In addition, model has no naval module.

PLANNED IMPROVEMENTS AND MODIFICATIONS: There will be no improvements or modifications.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer: None.

Storage: Only storage requirement is the need for a room to store your Dunn Kempf kit.

Peripherals: Three-dimensional boards, miniature tank, APC for both the BLUE and the RED armies, and maps.

Language: N/A.

Documentation: Very well documented with quite a number of supplements.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1976.

Data Base: None.

CPU time per Cycle: None.

Data Output Analysis: None.

Frequency of Use: Not used much anymore; it has mostly been replaced by FB:B-C.

Users: The Infantry School, Armor School, and Officer Basic Course.

Comments: N/A.

TITLE: DWG - Divisional War Game

MODEL TYPE: Analysis (but has some training value in relation to the use of future systems).

PROPONENT: RARDE, Fort Halstead, Sevenoaks, Kent, England TN14 7BP.

POINT OF CONTACT: The Superintendent, Indirect Fire System Studies Division, RARDE (UK) 0959 32222 X3005.

PURPOSE: The DWG is a research and evaluation tool used to examine the effectiveness of weapon system and tactical concepts at the brigade and division levels. It contributes to a wide range of assessment studies through the provision of performance and scenario data.

DESCRIPTION:
Domain: Land and air battle in the Central Region.

Span: Division/Corps.

Environment: Terrain is modeled as 500m-quadrants with cover and going types. Roads and rivers are represented, and intervisibility is based on matrices for fixed heights. Meterological conditions vary with time of day (both day and night are gamed).

Force Composition: Combined forces based on individual components and unit types (RED and BLUE).

Scope of Conflict: Conventional only (RED and BLUE).

Mission Area: All aspects of land and air battle.

Level of Detail of Processes and Entities: Varies between and within sides. Tanks are modeled as companies (RED) or combat teams (BLUE): rocket artillery is modeled as single vehicles (BLUE) or batteries (RED). Similarly, tube artillery (guns and mortars), helicopters, fixed wing aircraft, air defense, and engineering systems. Submodels assess the effect of interactions and attrition, and sightings are calculated explicitly at the unit level. Players issue orders to individual units. Communication nets are also modeled, and delays are calculated explicitly. The temporal resolution is six seconds.

CONSTRUCTION:
Human Participation: Required for decisions. In the absence of a decision, units run out of orders and suffer accordingly.

Time Processing: Dynamic, event-step (with a six-second time grain).

Treatment of Randomness: Direct fire attrition is based on Lanchester. Other models are stochastic with computation of kill/detection probabilities and Monte Carlo determination of outcome.

Sidedness: Two-sided, symmetric with approximately 20 players.

LIMITATIONS: None other than those appropriate to resolution employed.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Continuous program of model review particularly related to the systems of greatest interest in each series.

INPUT: Terrain data, unit characteristics (weapons, speeds, activities, deployments etc.), attrition data, and scenario-specific data (deployments, nets, orders).

OUTPUT: Relational data base of unit life histories. Event/occurrence diaries and system-specific trace files (e.g., BLUE/RED artillery).

HARDWARE AND SOFTWARE:

Computer:	Digital VAX running VMS.
Storage:	Game: 64MB; Disk/Type: approximately 2Gb.
Peripherals:	Variable but numerous (5 x Sigmex Graphics, 2 x microVAXII, approximately 40 x VT220, approximately 20 x printer).
Language:	VAX FORTRAN.
Documentation:	Out of date except for Function Specification.

SECURITY CLASSIFICATION: Secret (model and data not separate).

GENERAL DATA:

Date Implemented: 1978.

Data Base: From scratch requires 5-10 man-years; series setup requires 3 man-years including map boards.

CPU time per Cycle: Each 6 seconds of game time takes 60-180 seconds real time with a dedicated VAX 785.

Data Output Analysis: Interrogation of data base in response to specific requests.

Frequency of Use: Five to six one-month games per year.

Users: UK MOD (but others are possible with mutual agreement)

Comments: N/A.

TITLE: Eagle - Corps/Division Analysis Model

MODEL TYPE: Analysis and training.

PROPONENT: TRAC-FLVN, Fort Leavenworth, KS 66027-5200.

POINT OF CONTACT: Mr. Kent Pickett, (913) 684-4016.

PURPOSE: This effort will develop a fast-running systemic simulation for use by combat development studies involving new doctrine, scenario development, and future concept analysis. Eagle is designed for corps/division-level of analysis using object-oriented design, artificial intelligence, and state-of-the art software development tools. It will also serve the training community as a seminar exercise driver training tool.

DESCRIPTION:

Domain: Land and air.

Span: Any theater depending on data base.

Environment: Network terrain using 100-meter data points.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional and nuclear, BLUE and RED.

Mission Area: All U.S. Army conventional missions.

Level of Detail of Processes and Entities: Entities: maneuver battalions, artillery batteries, ADA batteries, air flights, and command post units. Processes: movement, direct and indirect fire attrition, air defense attrition, C2, and detection.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-step with air event stop overlays.

Treatment of Randomness: Land and air attrition deterministically based on Lanchester coefficients.

Sidedness: Two-sided, symmetric, reactive. Can be tested by a single operator or operated by two or more operators.

LIMITATIONS: Model development has just begun. Various stages will commence with functional areas added as time permits.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A. The command and control concept has just begun as the first step in developing the functional areas aspect of the model.

INPUT: 100-meter terrain points, weapons, movement, and unit characteristics.

OUTPUT: Produces graphic output of location by unit, status reports, etc.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a Symbolics or SUN with SUN Graphics.
Storage:	Undetermined.
Peripherals:	SUN Graphics only.
Language:	LISP and KEE.
Documentation:	N/A.

SECURITY CLASSIFICATION: Unclassified, but data bases will be secret.

GENERAL DATA:

Date Implemented: N/A. Eagle is currently being developed. Estimated completion data is late 1991.

Data Base: Months required to prepare input data.

CPU time per Cycle: Undetermined; prototype being developed.

Data Output Analysis: Postprocessor being developed.

Frequency of Use: Not yet being used.

Users: N/A.

Comments: N/A.

TITLE: ECECE - Electronic Combat Equipment Capabilities Evaluation

MODEL TYPE: Analysis.

PROPONENT: Studies and Analysis Directorate, The Air Force Electronic Warfare Center, ESC, San Antonio, TX 78243-5000.

POINT OF CONTACT: Rick Salinas or Lt. Harold Huguley, (512) 925-2391, AV 945-2391.

PURPOSE: The ECECE computer model is the upgrade model from Earborn. ECECE was developed to calculate a single number that represents the threat degradation achieved by an aircraft EC suite against a threat radar. This model aids the AFEWC/SATR branch in performing baseline evaluations of the Air Force's EC capabilities. These evaluations assist HQ USAF/XOE in making EC planning and budgetary decisions in support of the Electronic Combat Action Plan.

DESCRIPTION:

Domain: Land and air.

Span: Individual scenario.

Environment: Assume optimum environment conditions.

Force Composition: N/A (a single platform jammer vs. a single threat).

Scope of Conflict: Conventional (RED, BLUE, and GRAY).

Mission Area: Threat radar suppression.

Level of Detail of Processes and Entities: The model has only two entities, the aircraft and the threat radar. Since the model uses the radar range equation to formulate its results, the level of detail is fairly simple.

CONSTRUCTION:

Human Participation: Required for processing (data input).

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, symmetric.

LIMITATIONS: One target vs. one threat in good weather on smooth terrain.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The chaff, lethality, and J/S determination modules will be enhanced in the future.

INPUT: Scenario, aircraft, jammer, and weapon system data bases.

OUTPUT: Produces a computer screen display and a hard copy printout to a laser or dot matrix printer.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a VAX computer with a VMS operating system.
Storage:	Approximately 8000 blocks (4 MB) of memory are required for the executable code and data bases.
Peripherals:	A graphics terminal and printer.
Language:	FORTRAN 77.
Documentation:	None (program maintenance manual and operator/user's s manual are available for the older version of the model.)

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: The primary source for the parametric data used in all of the data bases is our unit's EC library. The library receives its information from national assets as well as from testing facilities.

CPU time per Cycle: 1-2 minutes.

Data Output Analysis: The output analysis is based on a single lethality number. To assist in the output analysis, four envelopes are printed out with each run (jammer gain, RCS, lethality, and J/S). Each envelope illustrates the point-by-point analysis around the threat radar. The summation of the point-by-point analysis determines the single lethality of the threat system. The four envelopes are compared to ensure consistent, and reasonable calculations.

Frequency of Use: Several times a year depending on tasking requirements.

Users: AFEWC/SATR.

Comments: N/A.

TITLE: EDECSIM - Extended Directed Energy Combat Simulation

MODEL TYPE: Analysis.

PROPONENT: CA4 Division, RARDE, Fort Halstead, Sevenoaks, England.

POINT OF CONTACT: D. F. Wardleworth, Tel: 0959 32222, Ext. 3388.

PURPOSE: The simulation is intended for the study of the interaction of conventional and novel direct-fire weapons systems effectiveness.

DESCRIPTION:
Domain: Land; limited air representation under development.

Span: Battlegroup level. Typical terrain measures 6 x 6 km.

Environment: Terrain height and vegetation/building cover are modeled to a horizontal resolution of 100 m. The effects of wind direction on obscuration can be represented. The model reproduces only day-time visibility at present.

Force Composition: The model is two-sided and can represent the essential characteristics of vehicle-borne weapons systems. Personnel and air systems are not represented.

Scope of Conflict: Conventional weapons: other systems are incorporated by program modification if suitable data is available.

Mission Area: Objectives other than enemy observation or engagement are not modeled.

Level of Detail of Processes and Entities: Individual vehicles and various weapon systems and ammunition types are represented. Inter-unit detection is modeled in some detail, and the outcome of surveillance and subsequent engagements is stochastic. Vehicle movement routes are prespecified and limited alternative reponses to battle development are possible. Communications can be partially represented. Artillery and minefields are modeled implicitly.

CONSTRUCTION:
Human Participation: Not interactive, but based on human reponses in the parent scenario (see Comments).

Time Processing: Dynamic, event-step.

Treatment of Randomness: The outcome of surveillance and engagements is determined by generating random numbers and comparing them with probability data.

Sidedness: The model is currently two-sided and may involve variable numbers and types on each side (i.e., the sides are interchangeable).

LIMITATIONS: Excessive divergence from the course of battle envisaged when specifying movement/activity data could lead to inappropriate actions in new tactical situations. The maximum number of vehicles/units is 255. Maximum terrain size is 20 x 20 km.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Planned inclusion of helicopters and air defense.

INPUT: Data defining terrain, weapons systems and lethality, vehicle characteristics, unit deployment, detection probability, minefield and artillery locations and types, and engagement/activity rules.

OUTPUT: Listings of all detections/engagements by time or by range (with units involved), weapon type, and outcome; interunit effectiveness matrix; exchange ratios/fractional exchange ratios by time; and overall means and standard deviations. Plots of unit positions can be produced. A graphics package permits stored replications to be reviewed, with the option of halting playback to interrogate individual units in order to determine current status or activity.

HARDWARE AND SOFTWARE:

Computer:	DEC VAX 8700 or 785; VAX GPX-II required for graphics.
Storage:	For 29 minute scenario, input data requires 700 blocks, output requires 2000 blocks, and graphics output requires 47000 blocks.
Peripherals:	One suitable terminal, one printer, and one plotter.
Language:	Mainly VAX Pascal, some FORTRAN 77.
Documentation:	In progress.

SECURITY CLASSIFICATION: Program restricted.

GENERAL DATA:

Date Implemented: 1989.

Data Base: Preparation of data base up to one man-year, improvements in hand.

CPU time per Cycle: Depends on scenario; 18 minutes of CPU time were required for 1 minute of simulation when a VAX 785 was used to study 154 vehicles in a main defensive action scenario.

Data Output Analysis: A number of packages exist (see Output).

Frequency of Use: Two to four replication series per week.

Users: RARDE.

Comments: EDECSIM is used as a basic testbed to evaluate new concepts, with additional modules being written as necessary. Input data is usually based on man-in-the-loop war games such as JANUS.

TITLE: E-EFAM - Expanded Engineer Functional Area Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Engineer Waterways Experiment Station, ATTN: CEWES-EN-A, P.O. Box 631, Vicksburg, MS 39181-0631.

POINT OF CONTACT: Phillip L. Doiron, (601) 634-3855.

PURPOSE: E-EFAM is being developed as a series of high-detail engineering task models. These models will predict the performance of engineering equipment on mobility, countermobility, survivability, and general engineering tasks. The output of these models will be used in the development of scenario data for war games as well as for analysis of engineering equipment and functions.

DESCRIPTION:
Domain: Land.

Span: Based on 1:50,000 scale map quadrangle.

Environment: Grid-based. Each 100m grid cell contains the terrain and environmental descriptions of the area. These terrain descriptions can include the topographic elevation; vegetation type, height, and density; soil type and moisture content; water depth, width, and velocity; urban structure height and density; and road type and width. The environmental descriptions can include type and amount of precipitation and the snow depth.

Force Composition: Engineering forces, both BLUE and RED.

Scope of Conflict: Conventional and unconventional.

Mission Area: Military engineer operations.

Level of Detail of Processes and Entities: The performance of each engineering task is simulated. The simulation is geared primarily toward analyzing the interaction of the engineering equipment with the terrain and environmental conditions occurring the selected minefield. The engineering tasks can be located anywhere on a 1:50,000 scale map quadrangle and can be of any size and configuration.

CONSTRUCTION:
Human Participation: Required for decisions.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Inability to simulate full RED engineer tasks.

PLANNED IMPROVEMENTS AND MODIFICATIONS: In the near future, foreign engineer mine systems will be included in the model.

INPUT: Relevant terrain and environmental factors and engineering system characteristics.

OUTPUT: Produces graphical display and tabular printouts of engineering system performance.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a MicroVAX computer with VMS operating system.
Storage:	13 MB required to run the model.
Peripherals:	Minimum requirements: 1 printer, 1 Raster 380 graphics terminal, 1 VT100 terminal.
Language:	FORTRAN.
Documentation:	Conceptual design document (in preparation).

SECURITY CLASSIFICATION: Model is unclassified, but some data and model outputs are classified.

GENERAL DATA:

Date Implemented: Under development.

Data Base: 3 months to prepare digital terrain data base.

CPU time per Cycle: N/A.

Data Output Analysis: Manual.

Frequency of Use: Used when required to research and development efforts.

Users: U.S. Army Engineer Waterways Experiment Station.

Comments: Model is presently being developed with a completion date in FY 1995.

TITLE: EIEM - Electromagnetic Interference Effects Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Electronic Proving Grounds, ATTN: [STEEP-(T-E)], Fort Huachuca, AZ 85613-7110.

POINT OF CONTACT: Steven C. Cooper, (602) 538-4953, AV 879-4953.

PURPOSE: The EIEM is an operational support tool that is used to assist in conducting compatibility and vulnerability analysis of communications and electronic equipment and systems in tactical deployments. The output is used to determine if systems are suitable for deployment.

DESCRIPTION:

Domain: Land and air. Limited space and naval.

Span: Accommodates any theater depending on data base. Can model individual equipment to full corps and above deployments.

Environment: Detailed RF phenomonology model. Models the effect of terrain and ground constraints in either area prediction or point-to-point mode. Options available to use Defense Mapping Agency digitized terrain data as input. Effects of time of day, month, and climatology are considered for various propagation models.

Force Composition: Joint and combined forces, BLUE, GREY, and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All phases of conventional warfare.

Level of Detail of Processes and Entities: EIEM uses deployment data concerning the location, terrain, and required linking of communications-electronics equipment contained in a tactical force to calculate the communicability, compatibility, and vulnerability of communications-electronic systems. EIEM samples a required number of links and initially determines the probability of communication (compatibility) over a link without interference based upon equipment technical performance characteristics and propagation losses. The model then computes the propagation loss for each possible interferer and computes a desired versus interferer signal ratio. The model then computes the probability of correct information transfer (compatibility), using previously measured performance data (scoring) for each communications-electronics equipment. The effects of jamming (vulnerability) on each link are similarly calculated by substituting the jammer as the interferer. ESM functions of intercept and DF are also modeled. For DF, the model can produce both a numerical probability of DF and an associated CEP value.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Statistical.

Treatment of Randomness: Can be run in either deterministic or probabilistic mode. Monte Carlo options are available for estimations of propagation variables from the mean.

Sidedness: Not applicable.

LIMITATIONS: Does not model specific effects of foliage or urbanization.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Propagation modules are under study for enhancement plus computer graphical development for file updates, data checks, and model output presentations.

INPUT: Tactical deployment data, equipment technical performance characteristics, propagation path loss parameters, and message traffic data.

OUTPUT: Printout of probability of communications-electronics equipment/systems communicability, compatibility, and vulnerability performance in their intended tactical operational environment.

HARDWARE AND SOFTWARE:

Computer:	CYBER 180 Model 830.
Storage:	Variable. Requirements can be adjusted.
Peripherals:	Optimum number of disk and tape drives varies; variable mass storage requirements in size of data files determine requirements.
Language:	SLACS 5 (an extended FORTRAN 77).
Documentation:	Extensively documented with four manuals published.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:
Date Implemented: 1970.

Data Base: Preparation of complete new corps-size deployment with appropriate RED forces requires 1 year. Analysis requiring data modification for specific test system requires 1 to 2 months depending on system.

CPU Time per Cycle: Dependent on deployment size and number of equipment to be evaluated. Corps-size deployment can take 100 hours of CPU time.

Data Output Analysis: Hard copy printouts.

Frequency of Use: Varies, 4 to 6 analyses performed per year.

Users: Model is resident at USAEPG. Numerous analyses have been performed for a variety of government agencies.

Comments: The model is not machine independent. However, the model takes advantage of the CDC CYBER 60-bit word for optimizations of data storage and access and would require modification for other environments.

TITLE: EMSA - Electronic Warfare Multiple Sensor Analysis

MODEL TYPE: Analysis.

PROPONENT: CA1 Division, RARDE, Fort Halstead, Sevenoaks, Kent, England.

POINT OF CONTACT: PO/EWS, CA1 Division, RARDE, Fort Halstead, Sevenoaks, Kent, England.

PURPOSE: EMSA is an analytical system designed to process the output from the Electronic Warfare Simulation (EWS) to produce unit identities and locations.

DESCRIPTION:
Domain: Abstract.

Span: Depends on input electronic ORBAT.

Environment: None.

Force Composition: RED and BLUE land forces.

Scope of Conflict: Electronic warfare.

Mission Area: Conventional all-arms land battle.

Level of Detail of Processes and Entities: Classified.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Static.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: Cannot process radar information from the EWS.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Inclusion of terrain information in processing and ability to accept intelligence collected on radars.

INPUT: Electronic ORBAT and intercept, locate, and monitor reports from the EWS.

OUTPUT: Printout of unit identities and locations, computer file of unit identities, and locations for input to MIDAS.

HARDWARE AND SOFTWARE:
Computer: Designed to run on a VAX computer with the VMS operating system.
Storage: Minimum requirements: 5 MB main memory and 200,000 blocks (100 MB) disk space.
Peripherals: Minimum requirements: one VT100 terminal and one printer.

Language: Qunitus PROLOG, DCL.
Documentation: User guide, system description and programmer guides, and electronic ORBAT description.

SECURITY CLASSIFICATION: Classified.

GENERAL DATA:
Date Implemented: Current version: April 1989.

Data Base: Two man-days to accept a new electronic ORBAT.

CPU time per Cycle: Depends on data base size. Typically requires five minutes of CPU time to process two hours of data.

Data Output Analysis: Output file for input to MIDAS.

Frequency of Use: As required.

Users: RARDE.

Comments: N/A.

TITLE: End-Game

MODEL TYPE: Analysis.

PROPONENT: Vitro Corporation, 14000 Georgia Ave., Silver Spring, MD 20906.

POINT OF CONTACT: A. J. Ondrish, (301) 231-2097.

PURPOSE: End-Game is used by engineers and analysts to evaluate the terminal phase of a missile versus a target (aircraft/missile) engagement.

DESCRIPTION:
Domain: Air.

Span: Area of intercept.

Environment: Air.

Force Composition: One STANDARD Missile (SM) versus one aircraft or missile.

Scope of Conflict: Conventional warhead on SM.

Mission Area: AAW.

Level of Detail of Processes and Entities: This model consists of an interactive graphics program that generates a 3-dimensional picture of the intercept showing both the target and the missile. The advanced graphics program takes about 1 minute 20 seconds to develop the image and about 18 seconds to redraw the image. Redrawing may use one or more of the optional features available, such as zooming, target translation, fuze radar cone alteration, and shading. Image is multi-color, with multi-views, as desired. The graphic display uses a missile-centered coordinate system that provides hidden line removal.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: SM versus target.

LIMITATIONS: Hidden line removal has not been completed.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: This model is incorporated into the TOTAL ROUND model for simulation of SM trajectories. It uses the output of TOTAL ROUND, which are kinematic, as well as geometric quantities such as target or missile velocity.

OUTPUT: Graphics.

HARDWARE AND SOFTWARE:

Computer:	HP 9845C and HP 9020C.
Storage:	170 KBYTES.
Peripherals:	Screen copier desirable.
Language:	HP Rocky Mountain Basic.
Documentation:	Clear notes.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1983, upgraded 1987.

Data Base: Program has 2000 lines of code.

CPU time per Cycle: The HP9845C requires 1 minute 20 seconds to develop image and 18 seconds to redraw the image after modification. The HP 9020C requires less time.

Data Output Analysis: N/A.

Frequency of Use: Occasionally needed during fuze studies.

Users: Vitro uses End-Game in support of NSWC, JHU/APL, and NAVSEA.

Comments: N/A.

TITLE: Engage

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SASB).
Pentagon, Rm 1D380, WASH, D.C. 20330-54

POINT OF CONTACT: Maj John Rolando, AFCSA/SASB, ext. 79804.

PURPOSE: Engage estimates the probability of detection and conversion that an air interceptor will detect and convert on a penetrating air vehicle.

DESCRIPTION:
Domain: Air.

Span: Individual.

Environment: Terrain can be varied by changing the backscatter coefficient (varies the clutter).

Force Composition: One penetrator and one interceptor.

Scope of Conflict: Conventional or nuclear.

Mission Area: Strategic or tactical air interdiction.

Level of Detail of Processes and Entities: The entity is individual aircraft or cruise missile, and the process is movement.

CONSTRUCTION:
Human Participation: Required only for setup of parameters.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: No electronic countermeasures, constant speed for penetrator and interceptor, and radar probability of detection and conversion only (no IR or visual).

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Speeds, radar cross section, altitude, clutter, kinematics, single sweep detection probability, other radar performance factors, and signal-to-noise criteria.

OUTPUT: Printout of probability of detection and conversion from various attack axes.

HARDWARE AND SOFTWARE:
Computer: IBM 3084 or a VAX 11/780.
Storage: N/A.

Peripherals: N/A.
Language: FORTRAN H extended.
Documentation: Engage User's Manual.

SECURITY CLASSIFICATION: Source code is unclassified.

GENERAL DATA:
Date Implemented: 1977.

Data Base: Few hours.

CPU time per Cycle: A typical case takes about one real-time minute.

Data Output Analysis: One week.

Frequency of Use: Varies depending on SASB analytic requirements.

Users: SASB.

Comments: None.

TITLE: EOVAC - Electro-optical Vulnerability Assessment Code

MODEL TYPE: Analysis.

PROPONENT: HQ AFOTEC/OAN (Modeling & Analysis Division), Kirtland AFB, NM 87117-

POINT OF CONTACT: Ms. Cheryl Black, AV 246-1938.

PURPOSE: EOVAC is used for laser threat engagement modeling and system vulnerability assessment.

DESCRIPTION:

Domain: Land and air.

Span: Any theater depending on the data base. Currently, the data base is limited.

Environment: Laser threat damage and influences of battlefield visual obscurants. Day and night conditions.

Force Composition: BLUE vs. RED.

Scope of Conflict: Conventional warfare, few-on-few engagements; emphasizes optical and electro-optical susceptibility and vulnerability.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: Depends on the level of detail of systems description in the data base. Retinal damage and battlefield obscurant effects are highly detailed.

CONSTRUCTION:

Human Participation: Needed prior to runs for scenario description and after run is complete to interpret results.

Time Processing: 10 times slower than real time.

Treatment of Randomness: All attrition based on direct computation of probabilities of detecting identified hit (time lased). Monte Carlo determination of results (user option).

Sidedness: Two-sided, reactive model.

LIMITATIONS: Data base is currently very limited.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Build data base and graphics.

INPUT: Terrain, weapons description and location, and vulnerabilities definitions.

OUTPUT: Retinal damage (eyes); laser damage, BLUE and RED movements during engagement; probabilities of detect, id, hit, kill; and miss distances.

HARDWARE AND SOFTWARE:

Computer: VAX 11/785 or comparable machine (VMS).
Storage: 1500 blocks (10 MB).
Peripherals: VT100 terminal, printer.
Language: FORTRAN 77.
Documentation: User's manual, data base specifications, and maintenance manual.

SECURITY CLASSIFICATION: Depends on data base (unclassified or secret).

GENERAL DATA:

Date Implemented: N/A.

Data Base: N/A.

CPU time per Cycle: 15 minutes to 1 hour of CPU time.

Data Output Analysis: Depends on site of engagement and options played.

Frequency of Use: Currently testing and verifying code.

Users: HQ AFOTEC/OAN, AFCSA/SAGR (new), and AFWL.

Comments: N/A.

TITLE: Error Analysis Using Multiple Ellipse Techniques for Use on Airborne Vehicles

MODEL TYPE: Analysis.

PROPONENT: CECOM AMSEL-PL-SA, Fort Monmouth, NJ 07703-5000.

POINT OF CONTACT: Ms. Valerie Ingels, (201) 532-4381, AV 992-4381.

PURPOSE: This research and evaluation tool enables an analyst to use the Error Analysis Model (ERAN) to perform an error analysis of a line-of-bearing target location system using multiple ellipse techniques.

DESCRIPTION:
Domain: Any combination of the identified items.

Span: Local.

Environment: N/A.

Force Composition: Component and element.

Scope of Conflict: Conventional.

Mission Area: Air, land, and sea.

Level of Detail of Processes and Entities: N/A.

CONSTRUCTION:
Human Participation: Required for input data.

Time Processing: Static.

Treatment of Randomness: Stochastic, direct computation.

Sidedness: One-sided.

LIMITATIONS: Single target.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Angle measurement, error-of-sensor, and other data identified in the 31 May 1988 user's guide and program documentation.

OUTPUT: Statistically analyzed data and other analysis (see 31 May 1988 user's guide and program documentation).

HARDWARE AND SOFTWARE:

Computer:	Any.
Storage:	Minimum storage required.
Peripherals:	Printer.
Language:	FORTRAN.
Documentation:	The ERAN model documentation includes a user's guide and program documentation manual that is located at the CECOM P&O Directorate, Fort Monmouth, NJ.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: N/A.

CPU time per Cycle: Negligible.

Data Output Analysis: Computer output is self-instructive and complete.

Frequency of Use: N/A.

Users: CECOM Center for Electronic Warfare/Reconnaissance Surveillance and Target Acquisition, Fort Monmouth, NJ.

Comments: N/A.

TITLE: ESAMS - Enhanced Surface-to-Air Missile Simulation

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SAGF), The Pentagon, Washington, DC 20330-5420.

POINT OF CONTACT: Maj Dave Yonika, (202) 694-4247, AV 224-4247.

PURPOSE: ESAMS generates one-to-one probabilities of kill for BLUE aircraft versus RED surface-to-air missile systems. The results are used in higher level survivability analyses to evaluate weapon system effectiveness.

DESCRIPTION:

Domain: Air and land.

Span: Individual.

Environment: Terrain relief.

Force Composition: Element.

Scope of Conflict: Conventional.

Mission Area: N/A.

Level of Detail of Processes and Entities: Entity: Single aircraft versus single missile system. Processes: Attrition.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo (also has a deterministic mode).

Sidedness: One-sided.

LIMITATIONS: One-on-one.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Aircraft radar and infrared cross sections, aircraft and component vulnerability characteristics, radar characteristics, missile performance, aircraft performance, aircraft flight paths.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer:	IBM 3081 (MVS), CDC CYBER, VAX 11/780 (VMS).
Storage:	10 MB.
Peripherals:	N/A.

Language: FORTRAN 77
Documentation: Available from SURVIAC (Model Repository), Wright-Patterson AFB.

SECURITY CLASSIFICATION: Secret, no foreign dissemination.

GENERAL DATA:
Date Implemented: 1983.

Data Base: 1 hour.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: 3-4 times per month.

Users: AF/SA, AFOTEC/OA, AD/EN, others.

Comments: None.

TITLE: EWS - Electronic Warfare Simulation

MODEL TYPE: Analysis.

PROPONENT: CA1 Division, RARDE, Fort Halstead, Sevenoaks, Kent, England.

POINT OF CONTACT: PO/EWS, CA1 Division, RARDE, Fort Halstead, Sevenoaks, Kent, England. Tel: Knockholt (0959) 32222 Ext 2353.

PURPOSE: The EWS is an interactive, computer-based simulation with generic models of communications and EW equipment permitting interactions between opposing elements to be explored in the context of a conventional all-arms battle.

DESCRIPTION:

Domain: Land and air.

Span: Terrain data base currently restricted to Central Europe 1(BR) Corps region, although could in principle cover any region in any theater.

Environment: Aggregated terrain (500-meter resolution). Spot height and cover data required for each 500-meter square. Does not model roads, rivers, or barriers. Models atmospheric effects affecting radio communications.

Force Composition: BLUE and RED land forces. BLUE and RED air forces limited to EW platforms.

Scope of Conflict: Conventional; CNR communications and EW equipment.

Mission Area: Conventional all-arms battle.

Level of Detail of Processes and Entities: Dynamic scenarios derived from an external combat simulation like the Divisional War Game (DWG). Static scenarios may be set up from within the EWS. Units may be any size but are typically from individual vehicles to companies. Models individual radio and EW sets belonging to a unit, and models CNR communications network. Radio pathloss calculations performed using several propagation models that use the terrain data base. The generation, transmission, interception, jamming, and location of individual radio transmissions modeled explicitly. The storage and reporting of accumulated intelligence data also modeled. Directives may be issued to units to alter CNR configurations and radio set characteristics in response to communications needs or enemy EW activities. EW units may be directed to gather intelligence on radio transmissions and also to jam these transmission No ground or air attrition modeled.

CONSTRUCTION:

Human Participation: Not required with the automatic EW tasking, ECCM, and communications configuration options in operation. Simulation may be run in interactive mode with automatic or manual EW tasking and manual ECCM and communications configuration options. Processing of collected EW data may be performed manually or automatically using EMSA and the MIDAS.

Time Processing: Dynamic, time-step (at set rate) and event-step.

Treatment of Randomness: Message transmission, reception, and detection deterministically based on pathloss calculations. Transmitter location deterministically based on Stansfield. Message generation stochastically based on computation of probability from table of message generation rates.

Sidedness: Two-sided, symmetric, reactive. One operator can test and run it as batch simulation, and up to six operators may run it as an interactive simulation.

LIMITATIONS: Trunk communications systems and radars not modeled in detail.

PLANNED IMPROVEMENTS AND MODIFICATIONS: CNR message generation and transmission module being enhanced. Trunk communications system and radar modules will be enhanced in future versions.

INPUT: Electronic ORBAT, unit locations, movement, status, equipment characteristics, aggregated terrain data.

OUTPUT: Logging files from the data retrieval models for output to the DAP; printouts of EW intercept, locate, and monitor reports; and files containing EW reports for input into EMSA and MIDAS. The DAP, EMSA, and MIDAS packages help analyze the output.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on VAX computer with VMS operating system.
Storage:	Minimum required: 15 MB main memory, 150,000 blocks (75 MB) disk space, with additional 50,000 blocks per run (25 MB).
Peripherals:	Minimum requirements: two VT100 terminals, one printer, and one magnetic tape drive.
Language:	VAX FORTRAN 77, DCL, and RAPPORT.
Documentation:	Player guides, system description and programmer guides, model descriptions, electronic ORBAT descriptions.

SECURITY CLASSIFICATION: Classified.

GENERAL DATA:

Date Implemented: Current version: June 1988.

Data Base: Three man-months to generate a new electronic ORBAT.

CPU time per Cycle: Depends on data base size and number and type of EW sensors played. Typically requires 130 hours of CPU time to process 20 minutes of battle.

Data Output Analysis: DAP data base, EMSA, and MIDAS display system aids in analysis of output. Output may be via computer file (for down loading onto a PC) or hard copy.

Frequency of Use: As required.

Users: RARDE, DLOR (Ottawa), USAICS, and TRAC.

Comments: N/A.

TITLE: FACTS - Fleet AAW Model for Comparison of Tactical Systems

MODEL TYPE: Analysis.

PROPONENT: Weapons Effectiveness Branch (G11) of the Systems Analysis Division, Naval Surface Warfare Center, Dahlgren, VA 22448-5000.

POINT OF CONTACT: Mr. James Elmlinger, (703) 663-8851, AV 249-8851.

PURPOSE: FACTS was developed to satisfy the need for a software tool that could investigate the effectiveness of naval AAW weapon system concepts and upgrades while being simple enough to implement on high performance microcomputers. FACTS is primarily an AAW firepower model with multi-ship, multi-layer, multi-threat, and multi-raid capabilities. It accommodates multi-layer shipboard defenses against varied threat types. Different firing doctrines and layer selection algorithms can be implemented for each ship.

DESCRIPTION:

Domain: Sea and air.

Span: Has been used to model a single ship composed of up to three defensive layers defending itself as well as to model a task force (SAG, two CV Battlegroup, etc.) engaged in AAW.

Environment: No explicit model of the environment is used. The effects of certain phenomena can be accounted for by adjusting system performance parameters such as detection range, probability of kill, etc.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional AAW. Considers BLUE shipboard systems and RED ASCMs only.

Mission Area: AAW.

Level of Detail of Processes and Entities: The lowest BLUE entities modeled include missiles and bullets, launchers, and sets of illuminators and midcourse channels. The lowest RED entity modeled is an ASCM. Missile flyout is handled by a range/time-of-flight table, while missile kinematic capability is modeled by two hemi-ellipsoids that define the missile's minimum and maximum intercept boundaries. Launchers are characterized by slew time, firing rate, reload delays, and magazine capacity. If required, sets of illuminators may be defined for each defensive layer on a ship, or a single set may be shared between the primary and secondary layer.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric. Nonreactive threat.

LIMITATIONS: At most two integrated weapon systems plus one point-defense system per ship. Coordination by engagement corridors; otherwise, no explicit coordination algorithm. Number of entities limited only by the amount of virtual memory available. Outer air battle not modeled, and there are no provisions for modeling aircraft.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Add TEWA delay and expand data available for postprocessing.

INPUT: Weapon and threat descriptions and scenario data.

OUTPUT: Tables of summary statistics and a file containing a detailed event chronology for each replication. The latter is used as a data base for various postprocessors.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780 and MicroVAX II (VMS).
Storage:	≥2000 blocks (about 1 MB), 20000 blocks typically.
Peripherals:	Printer, Tektronix graphics terminal (optional).
Language:	Pascal.
Documentation:	FACTS Users Guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1983.

Data Base: Simple scenario requires less than eight hours.

CPU time per Cycle: Typically less than one minute.

Data Output Analysis: Cursory look takes less than eight hours.

Frequency of Use: Currently used almost every day.

Users: NSWC, NAAW, and NSPO.

Comments: Managed through the FACTS Steering Group (FSG). Continually updated based on priorities established by the FSG.

TITLE: FASTALS - Force Analysis Simulation of Theater, Administrative and Logistics Support

MODEL TYPE: Analysis.

PROPONENT: Forces Directorate, U.S. Army Concepts Analysis Agency, 8120 Woodmont Ave., Bethesda, MD 20814.

POINT OF CONTACT: Mr. Raymond G. McDowall, AV 295-1658.

PURPOSE: The objective of FASTALS is to develop balanced, time-phased support force requirements for a given combat force. FASTALS is used primarily for force planning studies and analysis generally in the context of the Defense Guidance Illustrative Planning Scenario.

DESCRIPTION:

Domain: Land.

Span: Accommodates one theater at a time.

Environment: Theater dependent.

Force Composition: Used to generate requirements for Army support units.

Scope of Conflict: N/A.

Mission Area: FASTALS is a computer program developed to generate the time-phased Army support requirements that result from a given combat simulation.

Level of Detail of Processes and Entities: Support requirements are generated for each unit type (functional area) including engineer, chemical, medical, etc. by SRC. The workload requirements needed to sustain the forces are also generated.

CONSTRUCTION:

Human Participation: Not permitted during execution.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Limited by the quality of input.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Develop automated routines to facilitate data entry and retrieval.

INPUT: The following data bases in magnetic tape form are used: Military Traffic Management Command weights file and Army MARC Maintenance Data Base.

OUTPUT: Force listing is in the form of a time-phased troop list indicating requirements by SRC.

HARDWARE AND SOFTWARE:

Computer: UNISYS 1100/84.
Storage: N/A.
Peripherals: Two 9-track, 6250-byte-per-inch tape drives.
Language: COBOL and FORTRAN.
Documentation: Users manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1971.

Data Base: One man-month or more depending on size of force and complexity of theater.

CPU time per Cycle: Thirty minutes.

Data Output Analysis: Two weeks or more.

Frequency of Use: Used approximately 20 times per year.

Users: USACAA, U.S. Army Logistics Center, U.S. Army Logistics Evaluation Agency.

Comments: N/A.

TITLE: Fast Stick

MODEL TYPE: Training and education.

PROPONENT: Air Force Wargaming Center (AFWC), Maxwell AFB, AL 36112.

POINT OF CONTACT: Col. T. Yax, AUCADRE/WGO, Maxwell AFB, AL 361112, (205) 293-6618, AV 875-6618.

PURPOSE: Fast Stick, a seminar exercise driver, teaches the basic tactical employment concepts of air superiority, interdiction, close air support, and reconnaissance.

DESCRIPTION:

Domain: Air operations against land and air targets.

Span: Present data base accommodates only a fictional location.

Environment: Day and night operations and weather.

Force Composition: Air assets only.

Scope of Conflict: Conventional warfare only.

Mission Area: Conventional missions including reconnaissance, electronic warfare, air defense, air offense, close air support, and interdiction.

Level of Detail of Processes and Entities: TACC level.

CONSTRUCTION:

Human Participation: Required for processes and decisions.

Time Processing: Dynamic, time- and event-step model.

Treatment of Randomness: Stochastic; attrition and targeting based on Monte Carlo determination.

Sidedness: Two-sided, asymmetrical model with controllers playing the side of the opposition.

LIMITATIONS:

PLANNED IMPROVEMENTS AND MODIFICATIONS: AFIT is developing a data base-driven version of the model.

INPUT: Players determine role of aircraft (CAS, recce, etc.), weapon loads, mission packaging, target allocation, spares allocation, response to tactical air requests, and response to enemy attacks.

OUTPUT: Produces printed reports on the following subjects: planned mission summary, aircraft allocation and weapons load summary, target summary, and day and night aircraft status reports. Model also provides an end-of-day summary including point total.

HARDWARE AND SOFTWARE:

Computer (OS): IBM compatible MS-DOS machine with floppy and hard disk drive storage and 640 KB RAM.
Storage: 1.0 MB for executable and 0.5 MB for disk work space.
Peripherals: Monochrome monitor (color optional) and printer required.
Language: MS-Pascal and MS-ASSEMBLER.
Documentation: User and maintenance manuals available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: February 1988.

Data Base: Occupies approximately 80 KB.

CPU time per Cycle: N/A.

Data Output Analysis: A monitor program recovers errors by both the system and the user and allows for hard copy analysis.

Frequency of Use: Used annually by Air Command and Staff College (ACSC). Frequency of use by other user is unknown.

Users: ACSC and the Marine Command and Staff College.

Comments: Managed through the review and configuration control board at the AFWC.

TITLE: FDM - Force Design Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency (CSCA-SP), 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: Dr. Schwabauer, (301) 295-1526, AV 295-1526.

PURPOSE: The model is employed in Agency studies that provide analytical support to the HQDA staff in its force development, structure, and accounting activities.

DESCRIPTION:

Domain: Land.

Span: Global (three theaters).

Environment: Linear goal programming--six types of terrain in theater, up to nine time periods.

Force Composition: Land forces; optimizes BLUE, RED is fixed.

Scope of Conflict: Conventional.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: The FDM is a linear goal programming formulation of the problem of designing U.S. Army Division Forces for a specified time frame. Forces are resolved to the level of divisions along with associated nondivisional combat support units and combat service support increments. Model solutions specify a proposed Army Division Force structure, its peacetime posture and its allocation among the theaters of one or more global scenarios. Goals include active and reserve end strength, recurring and nonrecurring costs, strategic deployment lift consumption, indices of theater combat potential, war reserve stock levels, major weapon production capacities, and others. Tradeoffs among structure modernization, readiness, and sustainability can be treated at a highly aggregated level.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step (in that structure is optimized for different time periods).

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: Dollar and other resource accounting is approximate, and therefore not suitable for budgeting purposes.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Separate goal programming equations in cost penalty and effectiveness penalty constraints and determine usable penalties.

INPUT: Force structure, costs, personnel, and war reserve stocks.

OUTPUT: Computer printouts, objective function and decision variable values.

HARDWARE AND SOFTWARE:

Computer:	UNISYS 1100.
Storage:	65K.
Peripherals:	CRT, printer.
Language:	FMPS, FORTRAN.
Documentation:	Under development.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1982.

Data Base: Eight months to prepare.

CPU time per Cycle: One minute or less.

Data Output Analysis: Two hours (can be more but is usually less).

Frequency of Use: 200-300 runs in yearly major study.

Users: U.S. Army Concepts Analysis Agency.

Comments: The model can be easily modified by changing the constraint equations. However, input data generation can be complex.

TITLE: FIRST FORAY (Revised Edition)

MODEL TYPE: Training (with limited development uses).

PROPONENT: Headquarters Land Force Command, New Zealand.

POINT OF CONTACT: LTC R. J. K. Hoskin, (09) 461-466, Ext. 857.

PURPOSE: FIRST FORAY is currently a manual command post exercise driver. It will be be redesigned as a computer-assisted simulation to support the training and development of essentially light infantry battalion and brigade-level forces in low-level or low-intensity conflicts, particularly in tropical environments.

DESCRIPTION:

Domain: Land with some air and maritime aspects.

Span: Local.

Environment: Two-dimensional terrain boards of 1:5,000 or 1:10,000 scale. Specially enhanced designs are available. Weather, light, and other environmental factors are included.

Force Composition: Any joint, combined, integrated, or national force including guerilla, irregular, or dissident forces. Detailed data on New Zealand operational and a specific opposing force has been developed (TOES). A computer version (FORD) has also been completed.

Scope of Conflict: Essentially light infantry operations in medium- to low-level conflict in a tropical environment. This includes supporting operations (artillery, engineers, air, etc.) and civil and paramilitary participation.

Mission Area: Low-intensity conflicts.

Level of Detail of Processes and Entities: Resolutions are generally at the section (squad) level and individual crew-served weapon system. Provision exists for detailed results at individual level if required for personnel and logistic purposes. Suppression, ammunition usage effects, etc., are included. Outcome is not necessarily casualty driven. Includes provision for patrolling, ambushing, sniping, infiltration, improvised explosive devices, civil disorder, and (through control measures) participation by police and other civil organisations. Conflict resolutions are based on a modified firepower score, Monte Carlo-based system.

CONSTRUCTION:

Human Participation: Extensive human participation is required.

Time Processing: Five-minute resolution periods.

Treatment of Randomness: Monte Carlo.

Sidedness: Two-sided or more, depending on scenario.

LIMITATIONS: Manpower-intensive. Present manual form is detailed and tiresome.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Undergoing total revision that will result in a computer-assisted version.

INPUT: Any detailed scenario and force organization.

OUTPUT: Tactical information at the appropriate level including personnel and logistic detail.

HARDWARE AND SOFTWARE:
Computer: N/A.
Storage: N/A.
Peripherals: N/A.
Language: N/A.
Documentation: N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1989 (planned).

Data Base: N/A.

CPU time per Cycle: Dependent on data available.

Data Output Analysis: N/A.

Frequency of Use: Approximately five battalion and two to three brigade command post exercises per year.

Users: Land Force Command.

Comments: Not yet sufficiently developed for substantive comment.

TITLE: FLAPS - Force Level Automated Planning System

MODEL TYPE: Analysis.

PROPONENT: HQ U.S. Air Forces Europe/Operations Analysis (DOA), APO NY 09633-5001.

POINT OF CONTACT: Mr. Jack Winger, DSN 424-6911.

PURPOSE: FLAPS automatically performs daily theater force planning functions for tactical air forces and quickly builds and optimizes air tactical operations plans with respect to limited assets. FLAPS is designed as a decision aid to support operations for developing courses of action as well as daily resource planning. It has been used in an exercise.

DESCRIPTION:

Domain: Air and land.

Span: Theater and regional.

Environment: Radar visibility obstructed by terrain. Bad weather represented by restricted operation zones. Models night and day operations.

Force Composition: One-sided; BLUE air against RED surface threats.

Scope of Conflict: Conventional.

Mission Area: Air-to-ground; close air support and offensive air support (interdiction/strike) refueling, and limited electronic combat for defense suppression.

Level of Detail of Processes and Entities: Entities: Bookkeeping down to individual target and individual aircraft (although not by tail number). Bookkeeping of munitions (by individual round) and fuel (by gallon). Optimization of flight path routing according to discrete state space with interval between points variable but usually a few kilometers. Target damage based upon mathematical probability, but no physical weapons effects calculated. Processes: Movement of aircraft, expenditure of fuel and munitions.

CONSTRUCTION:

Human Participation: Required for decisions. FLAPS waits for a decision.

Time Processing: Planning portion (called ATOGEN), event-step; display portion (called FLAPS), time-step.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: Electronic combat.

PLANNED IMPROVEMENTS AND MODIFICATIONS: User-friendliness to be improved in next model release.

INPUT: Subsampled DTED level I terrain, World Data Bank II maps, IMOM electronic order of battle, aircraft types, characteristics, BLUE air bases and force locations/arrivals, RED target locations, munitions types and stockpiles, conventional weaponeering effects.

OUTPUT: Printout of air tasking order displaying mission TOT, unit, quantity of aircraft in mission, target, ordnance load, alternative missions examined, reasons alternatives not selected. Interactive video color map shows flight routes, targets, refueling points.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a VAX computer with VMS operating system. Also runs on Siemens 7-580 mainframe.
Storage:	50-MB, on-line disk.
Peripherals:	Minimum requirements: 1 printer, 1 Tektronix 4125 graphics terminal (alternately Siemens 9732 CAD workstation), 1 VT-220 alphanumeric terminal.
Language:	FORTRAN 77, DCL.
Documentation:	User's manual and data base description document.

SECURITY CLASSIFICATION: Software unclassified but data bases are classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Initial population of data base can take several man-months; however, system designed for receiving data base updates from automatic sources.

CPU time per Cycle: As much as half an hour for several hundred missions.

Data Output Analysis: None.

Frequency of Use: Varies by use. Several times daily in exercises. Several times a year in analyses.

Users: HQ USAFE/DOA/DOO, ATOCH Sembach, Warrior Preparation Center, HQ PACAF/DOA, Intelligence Center of the Pacific, USCINCPAC/J55.

Comments: Managed by HQ USAFE/DOO. Central Europe scenario mature, Asian scenarios under development.

TITLE: FOF - Follow On Forces Model

MODEL TYPE: Training and education.

PROPONENT: HQ USAFE Warrior Preparation Center (WPC), Einsiedlerhof AS, Germany APO NY 09021.

POINT OF CONTACT: MSgt Thomas A. Phelps, 011-631-536-6159, AV 489-6159.

PURPOSE: FOF is an exercise driver used primarily for training by NATO battle staffs to exercise command, control, and communications procedures. It simulates the movement of rear-area units towards the battle fronts. It also permits attrition and time delays from enemy forces.

DESCRIPTION:
Domain: Land.

Span: Accommodates any theater depending on the data base used; current data bases include Central and Southern Europe and Turkey.

Environment: FOF is defined by a series of nodes that are linked together. Each node has a latitude and longitude location. The nodes represent a transportation network, typically consisting of roads or railways.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional rear-area interdiction.

Mission Area: Air interdiction.

Level of Detail of Processes and Entities: Entities can be units from companies up to divisions, depending on the scope of the exercise. Units can only be affected by damage and player input processes. The damage process can cause attrition to and delay units; the player input process can delay or reroute units as required.

CONSTRUCTION:
Human Participation: Not required; the model is interruptable at any time for player input.

Time Processing: Dynamic, time-step. FOF processes each cycle according to the battle time of the exercise. The time between cycles depends on the data base used.

Treatment of Randomness: Stochastic; Monte Carlo generation of delay and attrition values.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Maximum of 2000 units and 700 nodes can be modeled. Weather and geography are not factors in this model.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None at present time.

INPUT: Size input files must be present before the model can be run. They describe units, subunits, nodes, links between nodes, targets, and directed routes that may be specified for a unit.

OUTPUT: Produces printouts of movement, delays, attrition, and disposition of units after they reach their final destination. If desired, units can be displayed on graphics terminals.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a VAX computer with a VMS operating system.
Storage:	Executable program requires 4,000 blocks plus 15,600 blocks for the global section data base.
Peripherals:	Minimum requirements: one terminal and one printer.
Language:	FORTRAN.
Documentation:	One manual describing model operating procedures and data base build requirements.

SECURITY CLASSIFICATION: Unclassified, but data bases are typically classified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: One man-week required to build a normal data base.

CPU time per Cycle: Depends on data base size and player configuration. A one-hour cycle takes a few minutes of CPU time to process.

Data Output Analysis: Accomplished manually; an analysis file is created each cycle and is reviewed by analysis personnel.

Frequency of Use: Used several times per year.

Users: All NATO forces.

Comments: FOF can be run in conjunction with the WPC AWSIMS model, which simulates air combat, or with the WPC GRWSIMS model, which simulates ground combat. If GRWSIMS is being run, FOF must be operated on the same computer.

TITLE: FORCEM - Force Evaluation Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: Mr. W. Chandler, (301) 295-1643, AV 295-1643.

PURPOSE: FORCEM simulates AirLand activities in a theater of operations over an extended period (up to 90 days). It is a fully computerized simulation for application in studies and analyses of force planning and resource allocation issues. It is part of a three-level hierarchy of Army simulation models developed under the Army Model Improvement Program.

DESCRIPTION:

Domain: Land and air.

Span: Theater campaign. Current data base is Central Europe.

Environment: Terrain square of selectable size (5-30 km). Eight terrain types affect movement. Day and night differentiated for some operations. No weather is modeled. Road, rail, and water transport represented as networks.

Force Composition: Joint and combined forces (BLUE and RED). BLUE force partitioned into two components for resource accounting purposes.

Scope of Conflict: Primarily conventional; chemical module operational.

Mission Area: Theater ground operations with fire support (including air) and combat service support.

Level of Detail of Processes and Entities: The level of resolution of combat units is the division. Combat support and combat service support operations are represented by smaller organizational elements or as aggregates of smaller units. Functional submodels represent the major activities of target acquisition, communications, command and control, division engagement, fire support, air operations, unit movement, and combat service support. Without player interaction, command control is represented by automated decision processes at three levels in the theater (Corps, Army Group, Theater). Assessment of division battle is made through an analytic representation of a division engagement with sets of attrition coefficients calibrated to the results of engagements simulated by an independent division model. Air operations are represented by groups of aircraft, by mission (eight possible), in an air sector, or, in a few cases, theater-wide. Area air defense is considered at the same sector level.

CONSTRUCTION:

Human Participation: Not required but generally exercised. Model is interruptable, mostly for purposes of command and control.

Time Processing: Dynamic, time-step (12-hour time cycle).

Treatment of Randomness: Deterministic (no randomness). Some inputs are expected values generated from stochastic processes.

Sidedness: Two-sided, generally symmetric.

LIMITATIONS: No naval operations, weather factors, engineers, EW or rear area combat. Highly aggregated intelligence and communications.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Presently revising command and control and engagement process for asymmetric representation of BLUE and RED operations and for better representation of breakthrough and reserve and second echelon force employment. Upgrades to intelligence and target acquisition as well as addition of engineers planned. Nuclear module is under development.

INPUT: In-theater force units and assets; arrival schedule units and assets; theater scenario and plans; terrain; engagement results from division level simulation; weapons and equipment characteristics; C2 decision criteria; performance factors for surveillance, communications, repair, medical, transport, and other functions.

OUTPUT: Computer printout, giving status of units and assets over time; computer graphics map displays and graphs; hard copy plots and charts.

HARDWARE AND SOFTWARE:

Computer:	UNISYS 1100/84.
Storage:	1,000,000 to 3,000,000 decimal words, depending on scenario.
Peripherals:	Disk storage, demand CRT terminal, computer graphics terminal and plotter for input and output preparation, tape unit for checkpoint/restart capability.
Language:	SIMSCRIPT II.5.
Documentation:	In-house draft. Formal documentation not yet published.

SECURITY CLASSIFICATION: Unclassified, without data.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Three to six months required to build completely new data base.

CPU time per Cycle: Depends on scenario. Average of 15-20 minutes per 12-hour cycle.

Data Output Analysis: Highly variable. Large volume of output is reduced, combined, and manipulated by a postprocessor information retrieval system (UNISYS MAPPER).

Frequency of Use: Twice per year for major studies.

Users: U.S. Army Concepts Analysis Agency.

Comments: Model operates in hierarchical mode and depends on results from higher resolution division model (presently COSAGE) for combat attrition and munition expenditures.

TITLE: FORCOST - Force Costing Model

MODEL TYPE: Training and education.

PROPONENT: War Gaming and Simulation Center, Institute for National Strategic Studies, National Defense University (NDU-NSS-WGSC) Ft. McNair, Washington, DC 20319.

POINT OF CONTACT: R. D. Wright, (202) 475-1251, AV 335-1251.

PURPOSE: To calculate obligational authority, outlay, and military personnel requirements for 10-year defense programs for educational exercises and research studies. The model helps users meet fiscal guidance while inflicting minimal damage to force capability or calculate the cost of an adequate force. Off-line discussions and assessments of risks are an essential part of the use of this model.

DESCRIPTION: The data base contains 100 elements with estimates (where appropriate) for RDT&E costs: item procurement and line open fixed costs and full share "ownership costs" annual operations and military personnel funding for force elements and their support and training slices. Users can examine alternate 10-year programs by specifying force structure (divisions, ships, squadrons with active/reserve mix), the pace of modernization (armored vehicle buys and new generation aircraft), sustainability investment, the level of operations, maintenance, and readiness funding, and major RDT&E program support. Users apply military judgment to assess the military capability that would result from their 10-year plan; the model does not provide measures of military capability.

Domain: Four services and DOD-wide programs and the Department of Energy weapons program.

Span: N/A.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Investment and operations costs for divisions, separate brigades, and like-size army support elements: MEFs/MEBs, individual ships, squadrons, and wings. Investment costs for major equipment items (like aircraft) assigned to operating units.

CONSTRUCTION:
Human Participation: Ten-year defense plan decisions, assessment of force capability and strategy-force capability mismatch.

Time Processing: Ten annual steps.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: No model generated measures of force capability. No measures of how O&M funding levels affect readiness.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Data base revisions, menu-driven screen capability.

INPUT: Force units to be deployed each year, major equipment items reaching the force each year, munitions and sustainability stocks to be fielded, annual levels of O&M funding, and schedules for major RDT&E activities.

OUTPUT: Annual costs (with obligational authority preceding deployment), outlay and active and reserve military personnel.

HARDWARE AND SOFTWARE:

Computer:	A-Z-248 or IBM AT or clone with 640K memory, VAX.
Storage:	1 Megabyte hard disk.
Peripherals:	Printer.
Language:	FORTRAN.
Documentation:	FORCOST Databook and User's Guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: Two multi-team exercises per year.

Users: NDU Industrial College of the Armed Forces and National War College.

Comments: Source code maintained at NDU-NSS-WGSC.

TITLE: FORGE - The Force Generation Model

MODEL TYPE: Analysis.

PROPONENT: Defense Intelligence Agency, Ground Frontal Forces Branch, Bolling Air Force Base, Washington, DC 20340-6584.

POINT OF CONTACT: Mr. Henry J. Shields (202) 373-4004, AV 243-4004.

PURPOSE: FORGE is designed to assess the ability of certain European countries to mobilize, train, and transport combat forces up to the point where they are committed to combat. FORGE does not model combat.

DESCRIPTION:
Domain: Land.

Span: Accommodates any combination of theaters dependent upon data base and scenario. Global scenarios may be analyzed, but only at reduced levels of detail due to CPU size constraints.

Environment: FORGE models road and rail transportation networks. Seasons may be varied, but not weather.

Force Composition: RED ground forces.

Scope of Conflict: FORGE does not model combat; however, interdiction of lines of communication may be modeled to assess the time necessary to generate combat potential.

Mission Area: For location of dispersal areas and interdiction assessments, FORGE can model nuclear as well as conventional munitions.

Level of Detail of Processes and Entities: Entity: The lowest entity modeled is a division.

Processes: After scenario set-up, FORGE runs in three phases: mobilization, dispersal, and training (MDT); heuristic automated transportation system (HATS); and final preparation and deployment (FPD). During MDT, units are mobilized, dispersed, and trained. During HATS, the units are transported over the existing transportation network. During FPD, units are moved from their concentration areas to their point of commitment to battle.

CONSTRUCTION:
Human Participation: Required for decisions.

Time Processing: Combination; the MDT and FPD modules are static. The HATS module is time-step dynamic.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: The number of units that can be modeled in a given scenario is limited to approximately 1300 divisions. Larger scenarios will have to be

modeled with lower degrees of detail. Geographic features other than oceans and rivers are not modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The MDT module interface program is being written and changes to improve user friendliness and graphics are planned.

INPUT: Scenario, including mobilization day, D-day, days of combat per division, rate of advance, front boundaries, commitment locations, etc.

OUTPUT: Printed and graphic display. Printed output includes tabular results, dispersal area diagrams, movement tables, training time tables, transport time and routes used, and combat potential versus time data. Data is statistically analyzed. Expected values and standard deviations are provided.

HARDWARE AND SOFTWARE:

Computer: IBM 3090.

Storage: Minimum 400 MB.

Peripherals: IBM 3090 Printer, Tektronix 4696 Inkjet Graphic Plotter, Tektronix 4107 Terminal for graphics, and Delta Data 8620 Terminal for file manipulation. Both terminals are required. FORGE may be set up and executed on either terminal.

Language: FORTRAN 77.

Documentation: User's guide and analysts' guide.

SECURITY CLASSIFICATION: Model without data base is Secret.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Extensive.

CPU time per Cycle: Scenario dependent.

Data Output Analysis: Scenario dependent.

Frequency of Use: Monthly.

Users: DIA, DB-1B2.

Comments: N/A.

TITLE: FORGE - FORCEM Gaming Evaluator Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: Mr. W. Chandler, (301) 295-1643, AV 295-1643.

PURPOSE: The model simulates AirLand activities in a theater of operations over an extended period. It is an interactive simulation used for application in studies of operations and analysis of command and control issues.

DESCRIPTION:

Domain: Land and air.

Span: Theater campaign or multi-corps operation.

Environment: Terrain square of selectable size (5-30 km). Eight terrain types, including urban and water areas, affect movement. Day and night differentiated for some operations. No weather modeled. Road, rail, and water transport represented as networks.

Force Composition: Joint and combined forces (BLUE and RED). BLUE force partitioned into two components for resource accounting purposes.

Scope of Conflict: Primarily conventional.

Mission Area: Theater ground operations with fire support (including air) and combat service support.

Level of Detail of Processes and Entities: FORGE is an interactive gaming version of the fully automated Force Evaluation Model (FORCEM). The model is a computerized simulation of combat and support operations. Major submodels simulate command and control, communications, target acquisition, maneuver, air operations, combat service support, fire support, and engagement attrition. Units are represented as model entities with locations, performance capabilities and assets (equipment, weapons, vehicles, supplies, personnel). Assessment of division battle is made through an analytic representation of a division engagement with sets of attrition coefficients calibrated to the results of engagements simulated by an independent division model. Air operations are represented by groups of aircraft, by mission (eight possible), in an air sector (roughly Corp or Army) or, in a few cases, theater-wide. Area air defense is considered at the same air sector level.

CONSTRUCTION:

Human Participation: Approximately 13 decisions concerning maneuver forces are subject to gamer interaction and human decision-making at the top two command levels, Theater and Army Group. Other decisions are made on the same automated basis as in FORCEM.

Time Processing: Dynamic, time-step (12-hour time cycle).

Treatment of Randomness: Deterministic, but interactive gamer action introduces randomness.

Sidedness: Two-sided, symmetric.

LIMITATIONS: No naval operations, weather, engineers, EW, or rear area combat. Highly aggregated intelligence and communications.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Presently developing chemical and nuclear capability.

INPUT: In-theater force units and assets; arrival schedule units and assets; theater scenario and plans; terrain; engagement results from division level simulation; weapons and equipment characteristics; C2 decision criteria; performance factors for surveillance, communications, repair, medical, transport, and other functions; and gamer decision actions.

OUTPUT: Computer graphics map displays and graphs; alphanumeric menus and reports at CRT; hard copy plots and charts; computer printout, giving status of units and assets over time.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780 (VMS operating system).
Storage:	60 million bytes.
Peripherals:	Disk storage, printer, tape drive, one to seven gamer/controller workstations, each consisting of two VT100 terminals, a Ramtek monitor, and a graphics tablet.
Language:	SIMSCRIPT II.5, FORTRAN.
Documentation:	FORGE Gamers Manual and Program Maintenance Manual, Harris Corporation, November 1985. FORGE input, output, and logic covered by FORCEM documentation.

SECURITY CLASSIFICATION: Unclassified, without data.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Three to six months required to build new data base from scratch.

CPU time per Cycle: CPU time per 12-hour cycle is a function of the size of the force represented.

Data Output Analysis: Highly variable, depending on study. Large volume of output is reduced, combined, and manipulated by a postprocessor information retrieval system (UNISYS MAPPER).

Frequency of Use: Presently in operational test mode; no study application usage yet.

Users: U.S. Army Concepts Analysis Agency.

Comments: N/A.

TITLE: FPM - Force Planning Model

MODEL TYPE: Training and education.

PROPONENT: Air Force Wargaming Center, Maxwell AFB, AL 36112.

POINT OF CONTACT: Col. T. Yax, AUCADRE/WGO, Maxwell AFB, AL 36112, (205) 293-6618, AV 875-6618.

PURPOSE: FPM, a seminar exercise driver, addresses the problem of matching military forces to strategy requirements. It also covers the difficulties associated with the resource allocation process.

DESCRIPTION: FPM is patterned after the Planning, Programming, and Budgeting System from formulating national strategy through developing the defense budget. Players initially serve as the National Command Authorities to determine military strategy based on national objectives and perceived threats. Players then serve as the service staff to design a fiscally unconstrained military planning force. FPM then imposes fiscal constraints. Players must develop a programmed force costing within one percent of the limit and defend this force to a simulated Congressional committee.

Domain: The U.S. military procurement system, including weapons systems of the Air Force, Navy, Marines, and Army.

Span: N/A.

Environment: FPM portrays weapon system procurement at the Joint Staff staff level.

Force Composition: All services in procurement of major weapons systems.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: FPM allows procurement of up to 120 different weapons systems. It will not allow the purchase of subsystems.

CONSTRUCTION:

Human Participation: Required for processes and decisions.

Time Processing: Phased, event-step.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: User inputs inventory levels, cost factors, investment lead time, R&D lead time, and start year. User may also change inventories and withdraw obsolete weapons.

OUTPUT: FPM provides printed reports on dollar cost of weapon systems and cost factors of weapon systems. It summarizes program and service costs as well as DOD costs vs. a given budget. FPM also produces line graphs and pie charts to assist analysis.

HARDWARE AND SOFTWARE:

Computer:	IBM compatible MS-DOS machine with floppy and hard disk drive storage, 640 KB RAM. FPM requires the SMART integrated software system and a monitor (color optional but preferred).
Storage:	1.0 MB for executable and 0.5 MB for disk work space.
Peripherals:	Monochrome monitor (color optional), printer.
Language:	MS-Pascal and the SMART Project Language.
Documentation:	User manual and maintenance manual available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: March 1987.

Data Base: About 60 manhours to key-in.

CPU time per Cycle: N/A.

Data Output Analysis: Hardcopy via line printer.

Frequency of Use: Once per year.

Users: Air War College.

Comments: Managed through the review and configuration control board at the AFWC.

TITLE: FPM - Forces Planning Model

MODEL TYPE: Analysis.

PROPONENT: Force Structure, Resource, and Assessment Directorate (J-8), The Joint Staff, The Pentagon, Rm 1D964, Washington, DC 20318-8000.

POINT OF CONTACT: LTC K. M. Wanless, (202) 694-6491, AV 224-6491.

PURPOSE: FPM is an integrated, global model designed to assess the impact of budget and force structure changes. Investment, development, and operations and support costs are computed for DoD and the Services. Effectiveness modeling considers unit weapon system characteristics when determining and calculating force ratios and attrition.

DESCRIPTION:
Domain: Naval, land, and air.

Span: Global force description with the capability to model multiple theaters of combat.

Environment: Not considered.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conflict escalation from conventional warfare to chemical warfare, nonstrategic warfare, and strategic nuclear warfare. Model considers lift, mobility, and sustainability.

Mission Area: Ground combat, air combat, ground-vs.-air combat, interdiction, airbase attack, SAM suppression, close air support, escort, battlefield, and airbase defense.

Level of Detail of Processes and Entities: N/A.

CONSTRUCTION:
Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-step and event-step.

Treatment of Randomness: The Effectiveness Module (EM) is an aggregated, deterministic model of simultaneous combat in multiple theaters and at sea.

Sidedness: Two-sided, symmetric, reactive. However, in the case of ground combat in the EM, BLUE resources in the combat theater include the notional SPOD and a notional APOD; analogous resources for the RED side are not modeled in the EM.

LIMITATIONS: Geography; aggregate force-on-force.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Cost Module (CM) is being updated to more accurately represent new system purchases and their associated costs.

INPUT: Includes appropriate budget, force structure, system characteristics, and scenario data. Inputs are highly aggregated to facilitate fast operation. Calculations are . using cost factors that are loaded into the CM from the cost data base c e dynamically within the CM from information passed from the Integration Module (IM). Components of the EM have been extensively linked together in a dynamic structure to emphasize the interaction among ground, air, and naval forces as well as mobilization and lift capabilities.

OUTPUT: The IM primarily produces intermediate data files, which are read by the CM and the EM. The CM produces a variety of output files describing the costs of base case and revised force structure. EM output contains different levels of detail; a variety of measures of effectiveness for all theaters for all cycles for a broad overview to more detailed information on a cycle-by-cycle basis.

HARDWARE AND SOFTWARE:

Computer (OS): Designed to run on a DEC/VAX computer with a VMS operating system (Version 4.6), Forms Management System (Version 2.3), Code Management System (Version 2.3), and either TELL-A-GRAPH (Version 6.1) or DEC-GRAPH (Version 2.0) graphics routines.

Storage: 460,000 blocks needed before data base can be installed.

Peripherals: Minimum requirements: one VT100 terminal, one printer, and one graphics suite.

Language: DCL, FORTRAN, and SIMSCRIPT II.5.

Documentation: Extensively documented with 15 printed volumes.

SECURITY CLASSIFICATION: Unclassified with classified data.

GENERAL DATA:

Date Implemented: 1989.

Data Base: Large data bases required for integration, costs, and effectiveness modules and can take several man-years.

CPU time per Cycle: Depends on mode of operation and desired output; maximum CPU time to process is hours.

Data Output Analysis: Postprocessor graphics output aids in analysis. Hard copy data results also produced.

Frequency of Use: Once fielded, estimate usage is at least several times per year.

Users: The Joint Staff.

Comments: N/A.

TITLE: Frequency Hopping Model (including cosite variation)

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Electronic Proving Grounds, ATTN: [STEEP-(T-E)], Fort Huachuca, AZ 85613-7110.

POINT OF CONTACT: Mr. Steven C. Cooper, (602) 538-4953, AV 879-4953.

PURPOSE: The Frequency Hopping Model is an operational support tool (decision aid) used to assist in conducting compatibility and vulnerability analysis of frequency hopping communications and electronic equipment and systems in tactical deployments. The output is used to determine if systems are suitable for deployment. EMC/EMV analyses of the SINCGARS frequency hopping radio have been performed.

DESCRIPTION:

Domain: Land, air, and limited space and naval.

Span: Accommodates any theater depending on data base. Can model individual equipment to full corps and above deployments.

Environment: Detailed RF phenomenology model. Models the effect of terrain and ground constraints in either an area prediction or point-to-point mode. DMA digitized terrain data can be used as input. Effects of time of day, month, and climatology considered for various propagation models.

Force Composition: Joint and combined, BLUE, GREY, and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All phases of conventional warfare.

Level of Detail of Processes and Entities: Model uses deployment data concerning the location, terrain, and required linking of C-E equipment contained in a tactical force to calculate the communicability, compatibility and vulnerability of the C-E systems. This model samples a required number of links and based upon equipment technical performance characteristics and propagation losses initially determines the probability of communication (compatibility) over a link without interference. The model then computes the propagation loss for each possible interferer and computes a desired versus interferer signal ratio. The model then computes the probability of correct information transfer (compatibility), using previously measured performance data (scoring) for each particular piece of C-E equipment. The effects of jamming (vulnerability) on each link are similarly calculated by substituting the jammer as the interferer. ESM functions of intercept and DF are also modeled. For DF, the model can produce both a numerical probability of DF and an associated DEP value.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Static.

Treatment of Randomness: Can be run in either a deterministic or a probabilistic mode. Monte Carlo options are available for estimations of propagation variables from the mean.

Sidedness: Not applicable.

LIMITATIONS: Does not model specific effects of foliage or urbanization.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Propagation modules are under study for enhancement plus computer graphical development for file updates, data validation, and model output presentations.

INPUT: Tactical deployment data, equipment technical performance characteristics, and propagation path loss parameters.

OUTPUT: Printout of probability of C-E equipment/systems communicability, compatibility, and vulnerability performance in their intended tactical operational environment.

HARDWARE AND SOFTWARE:

Computer:	CYBER 180 Model 830.
Storage:	Variable; requirements can be adjusted.
Peripherals:	Optimum number of disk and tape drives varies; variable mass storage requirements in size of data files determine requirements.
Language:	SLACS 5 (an extended FORTRAN 77).
Documentation:	Extensively documented.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:
Date Implemented: 1982.

Data Base: Preparation of complete new corps-size deployment with appropriate RED forces requires one year. Analysis requiring data modification for specific test system requires one to two months depending on system.

CPU time per Cycle: Depends on deployment size and number of equipment to be evaluated. Corps-size deployment can take 100 hours of CPU time.

Data Output Analysis: Hard-copy printouts and data files suitable for statistical postprocessing.

Frequency of Use: One to six analyses performed per year.

Users: Model is resident at USAEPG. Numerous analysis have been performed for a variety of government agencies.

Comments: The model is not machine dependent. It does, however, take advantage of the CDC CYBER 60-bit word for optimizations of data storage and access, and would require modification for other environments.

TITLE: FROBAK - Front End-Back End

MODEL TYPE: AEM Analysis model Pre- and Postprocessor

PROPONENT: Air Force Center for Studies & Analysis, Rm 1D376, The Pentagon, Washington, DC 20301.

POINT OF CONTACT: LCDR Barrowman, (202) 697-8546, AV 227-8546.

PURPOSE: FROBAK is a series of five modules (Prober, DGZer, DAGGER, DEVAL, POSTAL) developed to expand the AEM allocation model into a process that allows for the treatment of detailed target data, defense modeling, and operational constraints.

DESCRIPTION:

Domain: Ground- and sea-based strategic offensive and limited ground-based defense systems.

Span: Single-sided (but sequential) worldwide strategic force application analysis.

Environment: Ground- and sea-based.

Force Composition: RED offensive missile threat and BLUE ground strategic defense system (or vice versa).

Scope of Conflict: Strategic offensive nuclear and defensive exchange analysis.

Mission Area: Strategic nuclear conflict.

Level of Detail of Processes and Entities: AEM target and weapon data bases are aggregated up to 400 target classes and 50 weapon classes. The front-end (FRO) automates the processing of target installation data bases and builds and aggregates aimpoints/DGZs, producing an AEM-ready target input deck. The back-end (BAK) postprocesses a resultant AEM allocation, assigning warheads to carriers at launch points, and re-evaluates the damage at the individual target installation level.

CONSTRUCTION:

Human Participation: Analyst identifies the aggregation and descriptive guidelines for aggregation of installations. Program is almost always run in batch mode.

Time Processing: Thirty minutes for DGZing; less for other modules.

Treatment of Randomness: N/A.

Sidedness: One-sided.

LIMITATIONS: The five modules of FROBAK are only loosely related into a consistent user interface.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Automated DEVAL computations over time and missile range and footprint feasibility control and reporting.

INPUT: Target Base: file location of objective installations. Defense files: defense files location. Weapons files: weapons lat/long and number of weapons at each site.

OUTPUT: AEM target class file input files to AEM; DGZ file: lat/long locations; strike files.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780 or better.
Storage:	Minimal; largest file required is usually the objective installation file.
Peripherals:	None required; terminal or line printer for report review.
Language:	FORTRAN.
Documentation:	User's Guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Supported by user-generated flat files.

CPU time per Cycle: Typical run times are less than 30 minutes.

Data Output Analysis: In form of line printer reports.

Frequency of Use: Weekly to quarterly.

Users: AF Studies & Analysis, The Joint Staff/J-8 NFAD, and many others.

Comments: None.

TITLE: FSTAM - Force Structure Trade-Off Analysis Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Engineer School.

POINT OF CONTACT: Charles Herring, (217) 373-7260.

PURPOSE: FSTAM is a testbed model used to provide a low resolution combined arms simulation that represents combat engineers at the level of detail needed by analysts at the U.S. Army Engineer School, to experiment with engineer force structure representations, to determine measures of effectiveness for engineer contributions to the combined arms battle, to prototype for exercise driver, and to explore the feasibility of running full-scale simulations in a personal computer environment.

DESCRIPTION:

Domain: Land and air.

Span: Theater or regional.

Environment: Hex-based model. Scale determined by data set. Four types of terrain, five levels of roads, four levels of rivers, day and night operations, weather, minefields, point obstacles, antitank ditches, blown bridges, military bridges, and survivability positions modeled.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional warfare with limited nuclear and chemical.

Mission Area: Conventional, combined arms teams. Includes eight types of engineer teams for mobility, countermobility, and survivability tasks.

Level of Detail of Processes and Entities: Maneuver units of any size; engineer teams; variable resolution determined by input.

CONSTRUCTION:

Human Participation: Required for decision, but model continues to run without a decision.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic; land attrition computed by firepower score method.

Sidedness: Two-sided, symmetric. Can be run by single operator or with gamers for BLUE and RED.

LIMITATIONS: 175 units total.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Addition of logistics and user interface improvement.

INPUT: Two modules support input: MAPMAKER for interactive map building and EDITDATA for data base input.

OUTPUT: Produces screen reports and printouts of movement, attrition, intelligence, and engineer activities.

HARDWARE AND SOFTWARE:

Computer:	IBM-AT or better with math coprocessor.
Storage:	2 MB of RAM.
Peripherals:	EGA and monochrome monitor.
Language:	FORTRAN 77, Lahey EM/16.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Depends on scope; can be as little as one person-week.

CPU time per Cycle: Depends on data.

Data Output Analysis: Produces hard copies of raw data.

Frequency of Use: Varies.

Users: U.S. Army Engineer School.

Comments: N/A.

TITLE: G2WS - G2 Workstation

MODEL TYPE: Training and education.

PROPONENT: Commander, ATTN: ATSI-TD-TR, United States Army Intelligence Center and School, Ft. Huachuca, AZ 85613-7000.

POINT OF CONTACT: Maj. William Carrington, (602) 533-3364, AV 821-3364.

PURPOSE: G2WS is a simulation that replicates the division intelligence cycle in a classroom environment. It is used to train intelligence professionals from the corps level to the CEWI Bn. It is also used to test new intelligence and electronic warfare (IEW) doctrine developed at the Intelligence Center and School.

DESCRIPTION:
Domain: Land and air.

Span: Uses only the central European theater (Fulda Gap scenario).

Environment: Uses digital terrain and elevation data from the Defense Mapping Agency. Also distinguishes between day and night in reference to radio emissions.

Force Composition: Joint and combined RED forces.

Scope of Conflict: Conventional warfare.

Mission Area: All IEW missions for most ground and air IEW platforms.

Level of Detail of Processes and Entities: RED forces modeled to companies and platoons. RED attrition, communications, and movement are predetermined (in data bases) for the entire battle.

CONSTRUCTION:
Human Participation: Required for processes (tasking of IEW sensors and evaluation of intelligence reports).

Time Processing: Time-step and event-step; runs 1:1 or real time.

Treatment of Randomness: Stochastic simulation based upon direct computation.

Sidedness: One-sided with only RED forces modeled.

LIMITATIONS: Currently limited to one scenario, although the exercise is data base dependent and could be expanded to other scenarios. Attrition is not played interactively, making BLUE targeting and interdiction ineffective.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The JANUS combat force-on-force model will be used as the IEW simulation driver, making G2WS interactive in terms of attrition, scenario flexibility, movement, communication and radar emissions. In the "interactive" G2WS, scenario development time will be sharply reduced. A working prototype is complete and a full system will be ready by January 1990.

INPUT: Scenario data is opposing force unit strength, deployment, locations, and movement and the operational characteristics of sensors. Other critical information includes radar emission policies and radio net structures.

OUTPUT: Sends out intelligence reports based upon the placement and tasking of the intelligence assets. The better the placement and tasking of the IEW sensors, the more intelligence messages the players will receive. The players' performances dictate the quality of intelligence.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/785 and 3 MicroVAXES running on VMS.
Storage:	5 RA-60s.
Peripherals:	32 VT220 terminals, 20 desk printers, 2 multiplexers, 1 line printer, and Ethernet.
Language:	N/A.
Documentation:	Documentation available through proponent.

SECURITY CLASSIFICATION: Unclassified, but data bases are classified Top Secret-SCI.

GENERAL DATA:
Date Implemented: 1986

Data Base: Data base preparation takes 1.5 years (will be 3 to 6 months for interactive G2WS).

CPU time per Cycle: Can run 1:1 or real time.

Data Output Analysis: N/A.

Frequency of Use: Used by the Military Intelligence Officers Advanced Course, Advanced Noncommissioned Officers Course, and the Warrant Officers Training Course. Also used by FORSCOM and reserve intelligence units.

Users: Corps Cell - Corps Collection Management and Dissemination, Imagery Exploitation Cell. Division - G2, G3, EW, FSE, Collection Management and Dissemination, All Source Production Section, Counter Intelligence Analysis Section, Air Liaison Officer, Rear CP, Unmanned Aerial Vehicle. Aviation Brigade - S2. Brigades - S2, Intelligence Electronic Warfare Support Elements. CEWI Bn - S2, S3, Technical Control and Analysis Element.

Comments: The G2WS model is continually being tested, upgraded, and expanded at the Intelligence Center and School. FORSCOM and reserve intelligence units come to Ft. Huachuca to train their personnel using the model.

TITLE: GEMM - Generic Missile Model

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. Bill McQuay, (513) 255-2164.

PURPOSE: GEMM performs parametric studies of missile performance values to examine design constraints, studies the effects of counter-measures on missile performance, determines launch envelopes for a particular target and missile combination, and studies the effects of variable cross-section data.

DESCRIPTION:

Domain: Land, sea, and air.

Span: Local.

Environment: Site-specific details are not modeled. Clutter is estimated.

Force Composition: One missile and up to 20 targets.

Scope of Conflict: Any category of missile can be modeled although probability of kill tables must be provided.

Mission Area: N/A.

Level of Detail of Processes and Entities: The missile can be given any initial conditions and almost any type of weight/thrust/guidance combination. The effectiveness of each missile simulated is determined mainly by how close the missile gets to the target.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric. Both sides can be reactive.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: The inputs are supplied by the user in a card image file. Only those inputs for the specific system being modeled are input. The missile can be given any initial conditions and almost any type of weight/thrust/guidance combination.

OUTPUT: The major portion of the output is a time history of user-selected variables. The user can select from a list of over 200 variables to be printed as a function of time.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	274,000 bytes.
Peripherals:	No special requirements.
Language:	FORTRAN IV.
Documentation:	User's manual and Input Guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1975.

Data Base: N/A.

CPU time per Cycle: 8 minutes. Typical SAM, 40 KM launch.

Data Output Analysis: Manual analysis of tabular results.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: GEMMTLCM - GEneric Missile Model with Tracking Loops and Counter-Measure

MODEL TYPE: Analysis.

PROPONENT: Science Applications International Corporation (SAIC).
1100 FRANKLIN ROAD, SUITE 200, MARIETTA, GA 30067

POINT OF CONTACT: Mark D. Bond, SAIC, (404) 426-9359.

PURPOSE: The purpose of GEMMTLCM is to aid the missile systems analyst in the study of missile guidance and control against low observable (LO) aircraft. The secondary purpose of the model is to generate end-game geometry templates that can be mapped into probabilities of kill to feed higher order campaign-level models.

DESCRIPTION:

Domain: Land and sea.

Span: One aircraft on one missile system.

Environment: An associated off-line program builds a mask file from Defense Mapping Agency (DMA) terrain elevation data for use in target masking and clutter calculations.

Force Composition: Single element BLUE vs. RED or RED vs. BLUE.

Scope of Conflict: Accommodates any type of RF and IR, command and homing guided, surface-to-air, and air-to-air missile system.

Mission Area: Single penetrator with jammer against a single missile system.

Level of Detail of Processes and Entities: Lowest radar entity modeled is a radar subsystem: transmitter, pulse doppler or MTI circuit, noncoherent integrator, gain control. Pulse doppler and MTI processing limited to single spectral return in user-defined filter. Target fluctuation models limited to Swerling 1-4, Chi-squared, Weinstock, and nonfluctuating. Clutter reflectivity data from Lincoln Labs; limited to 9 types of land form and 5 types of land cover to form 45 combinations of land state. Lowest missile control system modeled is guidance control algorithm.

CONSTRUCTION:

Human Participation: Not required or permitted.

Time Processing: Dynamic, closed form solution. Output is end game geometry.

Treatment of Randomness: Deterministic; random noise sums to the mean (deterministic) over an integration period.

Sidedness: Symmetric.

LIMITATIONS: Does not model angle, range, or doppler tracking. Target fluctuation limited to Swerling models 1-4, Chi-Squared, Weinstock, or nonfluctuating.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Moving target detector (MTD: MTI followed by pulse doppler) will be added. Integration period algorithms for coherent jamming will be designed.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on VAX computer with VMS operating system.
Storage:	GEMMTLCM executable = 200,000 bytes. Input files = 100,000 bytes each (including antenna patterns). Mask files = 65,000 each (1 deg x 1 deg). Terrain executable = 30,000 bytes. TERMSK executable = 23,000 bytes. ALARMSS terrain elevation data files = 500,000 each (1 deg x 1 deg). DMA terrain elevation data files = 1,500,000 bytes each (1 deg x 1 deg). Associated menu driver and utilities executable = 50,000 bytes.
Peripherals:	No peripheral support required for operation. A graphics display terminal to view templates is recommended.
Language:	FORTRAN.
Documentation:	A user's manual and input guide are available.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Data base construction time is minimal provided that preparation is performed by a qualified radar analyst and aerodynamic engineer.

CPU time per Cycle: Depends on number of simulation points. An 80-point RF simulation would require approximately 4 CPU hours on a 4-MIP machine.

Data Output Analysis: Depends on level of engineering skills; generally extensive for analytic mode and less for template generation mode.

Frequency of Use: Extensive use by airframers in analysis of LO design.

Users: N/A.

Comments: Configuration is controlled by SAIC under contract to the Electronic Combat Digital Evaluation Systems at Wright-Patterson Air Force Base, Ohio.

TITLE: GENSAW - User-Assisted Generic Systems Analyst Workstation, Version 2.0

MODEL TYPE: Analysis.

PROPONENT: AAMRL/HE, Wright-Patterson AFB, OH 45433-6503.

POINT OF CONTACT: Dr. Robert G. Mills, (513) 255-7588, AV 785-7588.

PURPOSE: GENSAW is a research and evaluation tool that provides user-assisted analysis techniques for systems R&D. GENSAW is a comprised of a variety of systems analysis techniques including a simulation model development capability, SAINT Plus (formerly MicroSAINT). The information below deals only with the SAINT Plus capability.

DESCRIPTION:
Domain: Land, sea, air, space, and undersea.

Span: Global, theater, regional, local, or individual.

Environment: To be defined by the user or users.

Force Composition: To be defined by the user or users.

Scope of Conflict: To be defined by the user or users.

Mission Area: To be defined by the user or users.

Level of Detail of Processes and Entities: SAINT Plus is an event simulation modeling language. The level of detail of processes and entities is defined by the user or users.

CONSTRUCTION:
Human Participation: Required in model construction for decisions and processes. Generally, a model cannot be modified on-line to its execution. A model can be modified within GENSAW off-line to its execution. A model can be interrupted in order to freeze the output display during its execution. Schedule changes are executable within a model. Human participation is permitted during model execution but only if there is a desire to change a predefined variable's value.

Time Processing: Dynamic, event-stepped and closed form.

Treatment of Randomness: A model can be stochastic or deterministic depending upon user's problem and development.

Sidedness: A model can be one-sided or more depending on user's problem and development.

LIMITATIONS: Modeled system complexity and execution time.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Currently, SAINT Plus is a modeling capability limited to operator's workload data analysis. Planned improvement is to host GENSAW on a PC capability and expand the SAINT Plus data analysis portion to include a capability beyond operation(s) workload.

INPUT: Depend on a given model's development. Generally the input will include operator's task parameters as well as scenario, environment, and physical (e.g., aircraft aerodynamics) parameters.

OUTPUT: Computer printouts, plots, raw data, and statistically analysed data.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a Micro VAX II with Micro VMS 4.5 or greater and GKS 3.0.
Storage:	3639 blocks (1.9 MB) needed before GENSAW data bases are created.
Peripherals:	VR-260 terminal.
Language:	FORTRAN.
Documentation:	Technical documentation is available; there are no DDC accession numbers.

SECURITY CLASSIFICATION: Unclassified without a given problem structure, parameters, or data. SAINT Plus is an unclassified computer simulations language.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Preparation time depends upon user's problem. GENSAW provides automatic SAINT Plus code generation.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: N/A.

Users: GENSAW Version 2.0 has recently become available for field application. Aside from AAMRL, there are currently no other users.

Comments: N/A.

TITLE: GIFT - Geometric Information for Targets

MODEL TYPE: Analysis.

PROPONENT: N/A.

POINT OF CONTACT: James P. Billingsley, USAMICOM, Research, Development & Engineering Center, Bldg 5400, Redstone Arsenal, AL 35898-5000, (205) 876-5210, AV 746-5210, Dr. P.H. Dietz, USABRL, APG, MD 21005, (301) 278-6644, AV 298-6644.

PURPOSE: GIFT is a FORTRAN language code used to mathematically describe the three-dimensional geometry of a vehicle, such as a tank, truck, or aircraft. The geometric data generated by GIFT is input to vulnerability/lethality (V/L) computer codes that simulate the munition or warhead energy effects on the target. GIFT input and output is used extensively by USABRL and USAMICOM as the initial portion of the V/L assessment methodology.

DESCRIPTION:

Domain: GIFT can geometrically model ground, sea, and serial targets.

Span: N/A. GIFT is not a war game simulation code.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: The target combinational geometry (COM-GEOM) input to GIFT can be austere or highly detailed, depending on its intended use. Target COM-GEOM input may vary from one to thousands of geometric solid figures that are combined to model the vehicle. GIFT has a number of options and two of them are employed extensively in V/L assessment tasks. These are the Pictur and Grid options. Pictur produces exterior plots of the target as seen from arbitrary azimuth and elevation viewpoints. Portions of the target and cut away views can also be drawn by various Pictur suboptions. The Grid option produces a file (Grid) of detailed shotline data, which is an input to various V/L assessment codes.

CONSTRUCTION:

Human Participation: Required for input (COM-GEOM) preparation.

Time Processing: GIFT does not normally model time-dependent, transient events; user can modify or construct certain options that would model transient events.

Treatment of Randomness: Randomness in shotline modeling is a suboption in the Grid option.

Sidedness: N/A.

LIMITATIONS: Most problems can be traced to the COM-GEOM input. In the Grid option, the intersection of shotlines (geometric rays) with COM-GEOM solid intersections or edges can create a mathematical singularity situation. This may be corrected by varying the shotline position slightly.

With realistic COM-GEOM input, GIFT run time can be rather lengthy on even moderately fast machines. Efficient utilization requires a very fast machine or super computer. This is the most serious limitation of GIFT. COM-GEOM construction is a time consuming, tedious process. This can be a serious limitation if appropriate COM-GEOM is not available.

PLANNED IMPROVEMENTS AND MODIFICATIONS: USAMICOM and USABRL personnel have modified the basic Grid option to model canted warhead shotlines. An extension to the basic scheme has permitted simulation of optical sensing and fusing.

INPUT: Requires detailed target COM-GEOM input for realistic simulation

OUTPUT: Option dependent. The Pictur and Grid option outputs are used extensively in V/L assessment tasks and have been described above.

HARDWARE AND SOFTWARE:

Computer:	Efficient use requires a super computer but will run on certain minicomputers (for example HP-9000 series machines).
Storage:	Target COM-GEOM dependent.
Peripherals:	1 printer and 1 graphics unit or plotter.
Language:	FORTRAN.
Documentation:	Two manuals are available.

SECURITY CLASSIFICATION: Unclassified, but some input may be classified.

GENERAL DATA:

Date Implemented: Mid 1970s.

Data Base: A list of available vehicle COM-GEOM input is available from USABRL.

CPU time per Cycle: Highly dependent on size of COM-GEOM input and option selected as well as the computational machine. CPU can vary from a few seconds to several hours.

Data Output Analysis: No postprocessor is available but the Pictur option and suboption graphics greatly facilitate GIFT utilization.

Frequency of Use: Used daily by the following organizations.

Users: USABRL and USAMICOM.

Comments: The V/L division of USABRL has developed digital computer software that greatly facilitates the construction of COM-GEOM input to GIFT. This software is documented in: "The Ballistic Research Laboratory CAD Package, Release 3.0 (1 Oct 88), A Solid Modeling System and Ray-Tracing Benchmark". BRL-CAD includes Multiple Device Graphics Editor, which can be interactively employed to produce complex geometric models via combinations of primitive solids.

TITLE: GRWSIM - Ground Warfare Simulation

MODEL TYPE: Training and education.

PROPONENT: HQ USAFE Warrior Preparation Center (WPC), Einsiedlerhof AS, Germany APO New York 09021.

POINT OF CONTACT: TSPG (Mr. David L. Case), 011-631-536-6159, AV 489-6090.

PURPOSE: GRWSIM is used at the WPC as an exercise driver to train NATO commanders and their battle staffs in real-world combat decision making.

DESCRIPTION:

Domain: Land and air.

Span: Any theater depending on data base. Extensive WPC use in Central and Northern Europe.

Environment: Hex-based with 3.2-km hexes (variable). Each hex described by one of seven discrete terrain types and a set of transportation barrier values for each side. Day and night operations and limited constant weather modeled.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Primarily conventional warfare; limited nuclear and chemical effects.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: Unit is lowest entity modeled. Unit size and composition are data base build inputs and should be compatible with hex size and exercise objectives. Ground units seldom modeled lower than battalion level. Attack helicopters dynamically spawned as a 3-helo unit from larger units as needed and can attack specific weapon systems within an entity. Direct combat attrition evaluated on single entities, attack helicopters attrition on individual helicopters.

CONSTRUCTION:

Human Participation: Required for decisions and processes, but model will continue to run without player input.

Time Processing: Dynamic, time-step. Geared towards real-time operations.

Treatment of Randomness: Deterministic ground direct combat attrition based on Lanchester equations. Other attrition and random events based on probability tables with Monte Carlo determination of results.

Sidedness: Two-sided, symmetric, reactive.

LIMITATIONS: Needs VAX global section capability. There is limited weather and intelligence collection; limited chemical, nuclear, engineer, and fixed-wing play; no naval play; and 10,000-unit data base.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Enhance engineer play and remote distribution, add medical model, and increase attack helicopter fidelity.

INPUT: Companion programs control exercise. Program FIRST used by players to build initial data base and by controllers to alter game as required during play. Ground I/O program, GIO, allows players to interface with game during exercise. Other versions of GIO allow distribution of game to remote sites.

OUTPUT: Printouts of all player transactions and relevant events grouped by Major Subordinate Commands. Companion graphics programs can drive TEKTRONIC, SUN, or VAX WORKSTATION 2000 graphics hardware. Battle damage data written to flat files to support INGRES data base analysis.

HARDWARE AND SOFTWARE:

Computer (OS):	Designed for a VAX computer with a VMS operating system.
Storage:	52,000 blocks (26 MB) required for data base installation.
Peripherals:	Depends on exercise requirements. One VT 100 terminal required for execution. Player output can be stored on disk or automatically sent to a line printer. Companion programs have additional peripheral requirements.
Language:	VAX FORTRAN 77.
Documentation:	In-house programmer reference documentation; extensive published user documentation.

SECURITY CLASSIFICATION: Unclassified, but if classified data base is used, model generates classified data.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Several man-months for initial population of large data bases and several man-days for updating a data base for a particular exercise.

CPU time per Cycle: Depends on data base size, player configuration, and computer capability; typically 2 to 5 minutes of CPU to process 1 cycle of 20 game minutes.

Data Output Analysis: Periodic data extraction performed outside of GRWSIM. Snapshots of data base are taken for backup and restart capability and can be used for post-game analysis. Certain data are captured explicitly for analysis.

Frequency of Use: Depends on WPC exercise schedule. Typically used in six to seven major exercises per year.

Users: NATO commanders and their battle staffs. To date used by U.S. and German Corps in Central Europe and Land Southeast for Corps exercises; remoted to III U.S. Corps and 1ID in the United States; used by CENTAG and NORTHAG for Army group exercises. Planned users include the Netherlands and Belgium Corps and a full-up ACE exercise, including 21 Corps.

Comments: Managed by WPC Technical Support group and continually upgraded based on WPC needs. VAX global section capability allows linkage to other models through interface programs mapped to the data base.

TITLE: GUNFIRE - Air-to-Air Gun Program

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. William McQuay, (513) 255-2164.

PURPOSE: GUNFIRE is a research and evaluation tool that provides a simple, fast-running model for the effectiveness of rapid-fire air-to-air guns used against missiles and other aircraft. It can also be used for rapid-fire surface-to-air guns.

DESCRIPTION:

Domain: Air and land.

Span: Local and individual.

Environment: N/A.

Force Composition: One-on-one engagements.

Scope of Conflict: Conventional.

Mission Area: Predicts possibilities of hit for gunfire against airborne targets.

Level of Detail of Processes and Entities: GUNFIRE determines the probability of hit by a single shell, the probability of at least one hit by a stream of shells, and the expected number of hits by a stream of shells in an air-to-air engagement. It is also useful for modeling surface rapid-fire anti-aircraft artillery versus aircraft and/or missile engagements.

CONSTRUCTION:

Human Participation: Not required. Model is not interruptable.

Time Processing: Dynamic, closed form.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: No "sweeps" or strafing is modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: The user specifies the position, velocity, and acceleration vectors of the target and the gun platform. Other user inputs include the target cross section, gun parameters (rate of fire, dispersion, shell flyout velocity, etc.), and tracking and fire control parameters (tracking Az/El/Range errors, control loop delay, etc.).

OUTPUT: The basic output consists of a summary (at the terminal) of the time, the gun and target position, the probability of hit per shell, the probability of at least one hit from shells fired in the current increment, and the accumulated hit probability up to the current increment.

HARDWARE AND SOFTWARE:
- Computer: VAX 11/780.
- Storage: 25,126 bytes.
- Peripherals: Printer.
- Language: FORTRAN 77.
- Documentation: User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: September 1982.

Data Base: N/A.

CPU time per Cycle: Typically .52 seconds.

Data Output Analysis: Manual analysis of tabular results.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: HELSCAM - Helicopter Scenario Assessment Model

MODEL TYPE: Analysis.

PROPONENT: Directorate of Land Aviation/Project Management Office Canadian Force Light Helicopter, National Defence Headquarters, Ottawa, Ontario K1A OK2, Canada.

POINT OF CONTACT: Mr. Andy Boothroyd, (613) 992-8960, AV 842-8960.

PURPOSE: HELSCAM will be used primarily to analyze helicopter characteristics and equipment combinations for light observation, light armed, and attack helicopters in support of the ground commander. In particular, it can examine both weapon systems development and effectiveness as well as combat development doctrine.

DESCRIPTION:

Domain: Army units and helicopters.

Span: Local (up to about 30 weapon systems over an area measuring 20 by 15 kilometers for about 30 minutes of battle time).

Environment: Combination of 100-meter and 12.5-meter digital terrain, and general light level, visibility, and atmospheric extinction.

Force Composition: N/A.

Scope of Conflict: Conventional.

Mission Area: Primarily helicopter operations and the supported and enemy ground units.

Level of Detail of Processes and Entities: Entity: A weapon system, e.g., helicopter, tank, air defense unit, observation point, and armoured personnel carrier. Processes: Each unit can move; attain line of sight; and acquire (detect, recognize, and identify), interpret (what, color, damage, and activity), select, engage, communicate, and coordinate movement.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Advance, withdrawal, or halt along fixed paths only; helicopter aerodynamics not played (no helicopter versus helicopter); unit information never incorrect, only incomplete; shoot-look-shoot engagements only; one sensor per unit; and no survivability equipment.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Terrain data files and route planning facility to create and edit unit paths; the rest is in a large data file.

OUTPUT: Event logs are interpreted by graphical replay and analytical facilities.

HARDWARE AND SOFTWARE:

Computer:	Simulation core on a VAX computer and facilities on a Packard-Bell PC/AT microcomputer.
Storage:	No problem.
Peripherals:	None.
Language:	Simulation core in VAX FORTRAN 77, route planning and graphical replay facilities in Microsoft "C", and analysis facility in dBase III.
Documentation:	In preparation.

SECURITY CLASSIFICATION: Model unclassified.

GENERAL DATA:

Date Implemented: 1989 (expected).

Data Base: Two man-months.

CPU time per Cycle: Unknown.

Data Output Analysis: Unknown.

Frequency of Use: Unknown.

Users: Proponents.

Comments: HELSCAM is currently (April 1989) being tested and evaluated by its sponsors.

TITLE: HOME - Homing Missile Engagements

MODEL TYPE: Analysis.

PROPONENT: Studies and Analysis Directorate, The Air Force Electronic Warfare Center, ESC, San Antonio, TX 78243-50000.

POINT OF CONTACT: Roland Graves, (512) 925-2391, AV 945-2391. Jimmy Washington, (512) 925-2391, AV 945-2391.

PURPOSE: The HOME model is used to evaluate the effectiveness of infrared (IR) missiles against target aircraft under varying conditions.

DESCRIPTION:
Domain: Land and air.

Span: Individual scenario.

Environment: Assume normal environment conditions.

Force Composition: N/A (a single missile vs. a single target aircraft).

Scope of Conflict: Conventional (RED, BLUE, and GRAY).

Mission Area: Aircraft survivability through countermeasures.

Level of Detail of Processes and Entities: The model calculates the vulnerability of one aircraft to one infrared missile. Processes such as attenuation of target signature, dynamics of missile and target, and effectiveness of countermeasures are involved. Relevant effects of missile components (rather than the components themselves) are simulated.

CONSTRUCTION:
Human Participation: Required for processing (data input).

Time Processing: Dynamic.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Only one target may be used per simulation. Terrain masking effects are not considered. Output quality is dependent upon measured input quality.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Threat, target, and countermeasures data bases. Initial threat and target conditions.

OUTPUT: Vulnerability envelopes, miss distances, and flyout graphics.

HARDWARE AND SOFTWARE:

Computer:	VAX/VMS operating system.
Storage:	Two megabytes are needed for the executable code and the data bases.
Peripherals:	Tektronix 4125 series (graphics) terminal and a Tektronix 4692 series color graphics copier.
Language:	FORTRAN 77.
Documentation:	User's manuals from original procedures and local directorate.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: The primary source for the parametric data used in all of the data bases is obtained from our unit's electronic combat data library. The library receives its information from national assets as well as from testing facilities.

CPU Time per Cycle: Scenario-dependent.

Data Output Analysis: The output analysis is based on missile miss distances that occur close enough to the target to be considered lethal. Flyouts can be simulated from hundreds of different launch points by incrementing range and angle of the threat location as input. Flyouts can be performed against targets with and without IR decoys so that the relative effectiveness of the decoys can be determined.

Frequency of Use: Several times a year depending on tasking requirements.

Users: AFEW/SATC and AFEW/SAX.

Comments: None.

TITLE: ICAN - Integrated Cost and Need

MODEL TYPE: Analysis.

PROPONENT: ANSER Inc, 1215 Jefferson Davis, Suite 8.., Arlington, VA 22202.

POINT OF CONTACT: Mason Washington, (703) 685-3167.

PURPOSE: ICAN develops, maintains, and fosters analytic use of resource allocation and capability assessment models. ICAN models integrate multi-objective needs analysis with program resource analysis. These models serve as a mission capability assessment tool to assess the impact of cost or resource quantity changes.

DESCRIPTION:

Domain: Any domain as specified by the user.

Span: Any span as specified by the user.

Environment: Any environment as specified by the user.

Force Composition: Any force composition as specified by the user.

Scope of Conflict: Any scope of conflict as specified by the user.

Mission Area: Any mission area as specified by the user.

Level of Detail of Processes and Entities: Any level of detail supported as specified by the user. Models are static and discrete time unit driven. The hierarchical organization can accommodate 15 levels with 10 items per level. Appropriate allocation algorithm may need programming. ICAN currently uses a declining marginal returns algorithm. Resources are allocated to the most important objectives where the most important objective is achieved. Once the objective is achieved or resource expanded, the next best resource and objective allocation is addressed. Resource attrition and objective effectiveness are input by user. Model may run for up to 12 time periods.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Five hundred types of objectives maximum allowed for specification in the objectives tree. Two hundred fifty types of resources maximum allowed for resource specifications.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Provide another allocation algorithm that is rule-based. Enhance the resource and cost interface for program cost analysis of resources. Improve report generation function to furnish better graphics and analytic report features.

INPUT: Objectives (names, weights, relationships, and quantities). Resources (names, weights, and relationships). Resource to objective allocation description (resource effectiveness, sorties available, and resource attrition).

OUTPUT: Produces output of model description (tree diagrams, file dumps, etc.). Also produces computer reports or graphical depictions of calculated objective capabilities (summary and per objective). Also shows allocation results during model exemption.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on IBM AT microcomputer with a MS DOS operating system. Transportable to VAX computer with a VMS operating system or UNIX based computer.
Storage:	Minimum of 20 MB hard disk and 640K main memory.
Peripherals:	1 printer.
Language:	"C."
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Population of data bases is dependent on the size of the model.

CPU time per Cycle: Dependent on the data size of the model. Large models will usually take less than an hour to run.

Data Output Analysis: N/A.

Frequency of Use: Designed for frequent use of trade-off and sensitivity analysis of resource allocation option.

Users: Currently under final preparation for USSOCOM and SAF/LERD.

Comments: None.

TITLE: ICM - Intelligence Collection Model

MODEL TYPE: Training and education.

PROPONENT: HQ USAFE Warrior Preparation Center (WPC), Einsiedlerhof AS, Germany APO NY 09021.

POINT OF CONTACT: TSPG/EW, TSgt Daniel McAfee, 011-631-536-6090, AV 489-6090.

PURPOSE: ICM is an exercise driver that allows the tasking of intelligence collection assets and provides detailed intelligence reports. ICM can be configured for different levels of command post exercises. It is well suited for corps-level and echelons-level play, but can be and is being tailored for division-level play by the BCTP, Ft. Leavenworth, KS.

DESCRIPTION:

Domain: Intelligence collection assets are modeled in the air even if they are characteristically ground sensors because of the restrictions on movement that are imposed by the WPC's ground model.

Span: European theater is the current typical scale.

Environment: The descriptions of the sensors and platforms are mixed with certain sensors and platforms that are able to operate in all weather and in day and night configuration, while others are restricted based on their real-world capability.

Force Composition: Can produce some fused results to describe unit information.

Scope of Conflict: All conventional and unconventional warfare. Can detect all categories of weapons on either side of a conflict and in rear areas.

Mission Area: N/A.

Level of Detail of Processes and Entities: ICM is modeled to collect detail from the type of gun in the soldier's to the type of unit including the unit name and parent unit. ICM processes HUMINT, ELINT, COMINT, and IMINT sensor type collection activities.

CONSTRUCTION:

Human Participation: Required to produce any result. The model will run without the human factor but will not produce any results until valid collection orders are issued.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, both sides nonreactive.

LIMITATIONS: Limited by number of units, platforms, and sensors that can be represented in a single data base.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Improved data fusion and graphics display.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer (OS): Currently being run on VAX machines under VMS operating system.
Storage: Approximately 650 blocks required to load the program.
Peripherals: Output is dumped to printers, TEKTRONICS, and SUNS via other programs.
Language: FORTRAN.
Documentation: Technical handbook and user's guide.

SECURITY CLASSIFICATION: Model is unclassified. Input file classification depends on the sensor data base.

GENERAL DATA:

Date Implemented: May 1984.

Data Base: Data base creation time depends on the level of play desired. A permanent collector data base requires approximately three man-months. An exercise data base can be built in approximately one man-month.

CPU time per Cycle: Typically 3 to 5 CPU minutes are required to process one 20-minute cycle.

Data Output Analysis: An intelligence history file that contains all sensors taskings and collection results is maintained.

Frequency of Use: Used for all air and ground exercises at the WPC, which typically involves 10 to 15 major exercises per year.

Users: Players at the WPC and BCTP include NATO commanders and their battle staffs.

Comments: ICM is interlinked with the GRWSIM ground data base, which allows collection against all ground forces to include enemy follow-on forces.

TITLE: IDAHEX - Institute for Defence Analyses Hexagon Model

MODEL TYPE: Analysis.

PROPONENT: SHAPE Technical Centre, P.O. Box 174, 2501 CD The Hague, Netherlands.

POINT OF CONTACT: Dr. U. Candan, 31-70-142304.

PURPOSE: The IDAHEX model is a computer program that acts as a bookkeeper and a controller in a two-sided, computer-assisted, conventional analytical game. IDAHEX emphasizes player "generalship" (skill and style) and the principles of maneuver warfare while retaining substantial detail in unit characteristics and combat dynamics. IDAHEX terrain is divided into hexagons that regulate unit movement. Units are allowed to attack and move in six directions. The model represents maneuver and its consequences including noncontinuous FEBAs, breakthroughs, and encirclements. The model also is concerned with weapon-on-weapon attrition, supporting fire, offensive air support and air interdiction, engineer activities, and logistics. It is specifically designed to assess the sufficiency of force levels and operational concepts.

DESCRIPTION:

Domain: Land, limited offensive air support, and air interdiction operations.

Span: Mainly theater- or army-level applications. Several data bases (Central and Southern Regions of ACE) completed, while others in preparation.

Environment: Hex-based. Several different road and railway types can be represented. Each hex is assigned a terrain type, and natural or man-made barriers and shoulder space limitations can be represented on each hex. Day and night operations can be represented but not implemented in applications.

Force Composition: Combined forces, BLUE and RED.

Scope of Conflict: Primarily conventional land warfare with offensive air support and air interdiction inputs. All conventional land forces' weapons and their effects can be represented.

Mission Area: All conventional land warfare missions.

Level of Detail of Processes and Entities: Generally, RED divisions and BLUE brigades and regiments are represented. However, units at any level and of any size can be represented. Movement or attack, defend, withdraw, and delay directives can be issued to ground forces. Ground attrition is calculated by using weapon-weapon interactions. Logistics can be be modeled at any level of detail. Some engineering activities are represented. A stochastic algorithm is used to model the effects of intelligence operations.

CONSTRUCTION:

Human Participation: Required for decisions.

Time Processing: Dynamic, time- and event-step. Execution stops at the end of each cycle (four to six battle hours) and waits for planners' inputs to continue.

Treatment of Randomness: All processes are deterministic except FEBA movement and intelligence-gathering activities.

Sidedness: Two-sided, symmetric.

LIMITATIONS: There are no nuclear or chemical features in the model. Representation of air-ground combat is rudimentary, and air-air combat is absent.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Graphics applications and higher resolution geographical representation.

INPUT: Ground orders of battle: unit locations; terrain; road, rail and barrier types; movement rates; weapon-on-weapon attrition rates; engineer capabilities; supplied consumption rates; and attack and defense styles and postures. Air orders of battle: unit (base) locations, movement (range) limitations, and weapon-on-weapon attrition rates.

OUTPUT: Summarizes important events for the players at their terminals and files a detailed history for retention on tape or high-speed printing.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/8700, VMS.
Storage:	3500K.
Peripherals:	One to three terminals, high-speed printer, on-line printer.
Language:	FORTRAN 77.
Documentation:	"IDAHEX: A Manoeuvre-Oriented Model of Conventional Land Warfare," STC Publications TM-762 and TM-763.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: N/A.

Data Base: Three months to develop data base, two weeks to structure data in model input format. One day of player learning time for set-up. Playing time is six hours for one day of combat.

CPU time per Cycle: Two minutes.

Data Output Analysis: Two weeks.

Frequency of Use: Five major war games per year at STC.

Users: SHAPE Technical Centre, OSD (PA&E), Korean Institute of Defense Analysis, Turkish General Staff, Hellenic Armed Forces General Staff, Italian Department of Defense, British Operational Analysis Establishment, and Allied Forces Southern Europe.

Comments: N/A.

TITLE: IEW - Intelligence/Electronic Warfare Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Electronic Proving Grounds, ATTN: STEEP-(T-E), Fort Huachuca, AZ 85613-7110.

POINT OF CONTACT: Steven C. Cooper, (602) 538-4953, AV 879-4953.

PURPOSE: IEW is an operational support tool (decision aid). It is used to evaluate the capability of proposed IEW systems, to receive and process specified levels of message traffic, and to evaluate the performance of sensor systems.

DESCRIPTION:
Domain: Land, and air, and limited space and naval.

Span: Accommodates any theater depending on data base. Can model individual equipment to full corps and above deployments.

Environment: Detailed RF phenomenology model. Models the effect of terrain and ground constraints in either an area prediction or a point-to-point mode. Options available to use DMA digitized terrain data as input. Model considers effects of time of day, month, and climatology for various propagation models.

Force Composition: Joint and combined, BLUE, GREY, and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All phases of conventional warfare.

Level of Detail of Processes and Entities: IEW uses deployment data concerning the location, terrain, and required linking of communications and electronics equipment contained in a tactical force. The operation of intelligence sensors are simulated. The model represents the physics of signal transmission, interception of signals by sensors, and direction finding by multiple sensors.

CONSTRUCTION:
Human Participation: Not permitted.

Time Processing: Dynamic, event-driven simulation containing some closed-form representations of processes.

Treatment of Randomness: Can be run in either a deterministic or a probabilistic mode. Monte Carlo options are available for estimations of propagation variables from the mean and in the selection of the interference environment that is "on" at specific times in the scenarios.

Sidedness: N/A.

LIMITATIONS: Does not model specific effects of foliage or urbanization.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Propagation modules are under study for enhancement plus computer graphical development for file updates, data validation, and model output presentations.

INPUT: Tactical deployment data, equipment technical performance characteristics, propagation path loss parameters, message traffic data. Sensor technical data includes timing and setup parameters.

OUTPUT: Model outputs consist of the tactical reports issued by the sensors during the simulation. Sensor-reported information includes time of the report, time of the intercept, detected target characteristics, and perceived target location. Ground truth data is available to compare perceived versus actual battlefield information.

HARDWARE AND SOFTWARE:

Computer:	CYBER 180 Model 830.
Storage:	Variable; requirements can be adjusted.
Peripherals:	Optimum number of disk and tape drives varies; variable mass storage requirements in size of data files determine requirements.
Language:	SLACS 5 (an extended FORTRAN 77).
Documentation:	Extensively documented.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1983.

Data Base: Preparation of complete new corps-size deployment with appropriate RED forces requires one year. Analysis requiring data modification for specific test system requires one to two months, depending on system.

CPU time per Cycle: Depends on deployment size and number of equipment to be evaluated. Corps-size deployment can take 100 hours of CPU time.

Data Output Analysis: Hard-copy printouts and data files for postprocessing.

Frequency of Use: Approximately one analysis per year.

Users: USAEPG.

Comments: The model is not machine dependent. However, it takes advantage of the CDC CYBER 60-bit word for optimizations of data storage and access, and would require modification for other environments.

TITLE: IMOM - Improved Many on Many

MODEL TYPE: Planning and training.

PROPONENT: Air Force Electronic Warfare Center, Studies and Analysis Modeling Division (AFEWC/SAM), Kelly AFB, TX 78243-5000.

POINT OF CONTACT: Maj Tom Sterling, (512) 925-2521, AV 945-2521.

PURPOSE: IMOM is an integrated electronic combat mission planning system. It is specifically used to provide an overall picture of the EC environment as conditioned by the effects of terrain masking, stand-off jamming, and self-protection jamming. It visually depicts the limitations of radar and weapon systems coverage.

DESCRIPTION:

Domain: Land, air, and limited naval operations.

Span: All theaters, depending on digitized terrain data base.

Environment: Depicts radar coverage on scaled transparencies or acetate overlays for TPC and ONC charts.

Force Composition: Component.

Scope of Conflict: EC.

Mission Area: All missions involved with EC.

Level of Detail of Processes and Entities: Displays EW, GCI, and TA radar coverage based on radar detection range calculations, radar beam characteristics, radar scope limits, and terrain masking effects against target aircraft flying at a desired altitude above ground level. Also displays changes in radar coverage as affected by stand-off and close-in jamming. Displays weapons systems coverage based on terrain masking effects, envelope limits, and self-protection jamming effectiveness.

CONSTRUCTION:

Human Participation: Required for processes.

Time Processing: Static; computes a situation or event fully and displays it as one picture.

Treatment of Randomness: Deterministic; uses measured numbers, not statistics, and makes decisions based on determined effectiveness levels.

Sidedness: N/A.

LIMITATIONS: Does not currently model naval radars.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Optimum route analysis, fuel planning, and integration of naval EOB.

INPUT: Required radar parametrics, jammer parametrics, and order of battle information.

OUTPUT: Produces computer printouts depicting the EC environment and terrain masking effects along a route of flight.

HARDWARE AND SOFTWARE:

Computer:	MicroVAX II VMS operating system.
Storage:	5 MB of RAM.
Peripherals:	Tektronix 4125 or 4207 high resolution color graphics and Bruning 836 CS plotter.
Language:	VAX FORTRAN.
Documentation:	Version 4 to be released 30 November 88.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: DIA Electronic Order of Battle, DMA DTED Level I digitized terrain, WDB II Geo Political Boundaries, and EWIR Radar parametric data.

CPU Time per Cycle: Depends on EOB; varies from five minutes to two hours.

Data Output Analysis: None.

Frequency of Use: User-dependent; used daily to update mission plans.

Users: Major command users are USAFE, TAC, PACAF, and SAC. Will be used down to wing levels. The JIC, JEWC, and AFOTEC are other users.

Comments: Users' input and update requests go back to AFEWC/SAM. Software versions are continually upgraded to reflect users' requests.

TITLE: IMPACT - ITW&A Message Processing and Communications Traffic Model

MODEL TYPE: Analysis.

PROPONENT: NORAD/USSPACECOM Center for Aerospace Analysis (HQ NORAD/USSPACECOM AN), Peterson AFB, Co 80914-5001

POINT OF CONTACT: ~~Dr. Pat Sanders~~ Mr Brown, (719) 554-3945, AV 692-3945.

PURPOSE: The IMPACT model simulates the operation of a queued routing node operating on an input message stream. It is used as a research and evaluation tool to evaluate the capabilities of a node in a communications network to handle message loads.

DESCRIPTION:

Domain: A communications network.

Span: Simulates a single routing node in a communications network.

Environment: Models a routing node in a communications network. Processes message streams of various message types. With or without prioritization by message type.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: Created to support analysis of Integrated Tactical Warning & Assessment (ITW&A) message traffic handling, but usable for other types of message traffic.

Level of Detail of Processes and Entities: Analyzes effects of routing node on throughput of messages. Measures message delay times and queue sizes by message type, as a function of time and of throughput capability (e.g., bits per second), with or without prioritization by message type.

CONSTRUCTION:

Human Participation: Required for operation of the model and interpretation of results.

Time Processing: Dynamic. Simulates processing of stream messages and keeps track of message delay times and queue sizes (by message type) as a function of time.

Treatment of Randomness: Processes message stream deterministically in sequence as input by model user.

Sidedness: N/A.

LIMITATIONS: Simulated routing node can have no more than one input line and one output line (with same or different line rate capacities). Messages can be prioritized by message type, but not by individual message within a message type.

PLANNED IMPROVEMENTS AND MODIFICATIONS: TBD.

INPUT: Start time, end time, line communications rates (bits per second), priority scheme (if used), histogram interval, message stream, and, if a communications line disruption event is simulated, disruption event time and channel capacity after the event.

OUTPUT: Computer printout showing message types, priorities (if used), message lengths, communications line rates, message transmission time frames, numbers of messages received and delivered, message queue sizes and delay times (worse case, average, and as a function of time), and number of messages lost in the event of a disruption event. IMPACT also creates a graphic output file that can be transferred to a graphic presentation package.

HARDWARE AND SOFTWARE:

Computer:	Written in FORTRAN, exists on both DEC VAX Backup and IBM PC compatible MS/DOS 360K floppy disk media.
Storage:	Normally fits on a 360K disk, but the executable image may exceed the size of the 360K disk; the MS/DOS package includes all required libraries.
Peripherals:	Normal PC system configuration with hard-copy printer is needed. A graphic presentation package is needed for generation of graphic outputs.
Language:	N/A.
Documentation:	IMPACT Model User's Manual, 23 Sep 88, by Vanguard Research, Inc., Design Guidance for the IMPACT Model, 23 Sep 88, by Vanguard Research, Inc.

SECURITY CLASSIFICATION: Model without data is unclassified, but input messages may be classified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Varies depending on size and content of input message stream and upon method used by the model operator to create the input message stream.

CPU time per Cycle: Varies by size and content of input message stream.

Data Output Analysis: Varies depending on size and content of input message stream, number of types of messages included, time period simulated, and outputs selected.

Frequency of Use: Will vary depending on projects underway.

Users: NORAD and USSPACECOM analysts.

Comments: IMPACT is intended to be a simple model that simulates a single communications node in order to evaluate the effects of various levels of message traffic loads, communication line rates, and message prioritization arrangements on the flow of messages through the node.

TITLE: IPARS - Integration Period Airborne Radar Simulation

MODEL TYPE: Analysis.

PROPONENT: Science Applications International Corporation (SAIC).

POINT OF CONTACT: Mark D. Bond, SAIC, (404) 426-9359.

PURPOSE: The purpose of IPARS is to determine the detectability of airborne radar against an aircraft with a given cross section in an environment with limited clutter. Detection templates for user input aspect angeles around the aircraft are often fed to the mission level and campaign-level models such as SPEED and COMMANDER.

DESCRIPTION:

Domain: Air.

Span: One aircraft on one radar.

Environment: Round, smooth earth; atmospheric absorption.

Force Composition: Single element BLUE vs. RED or RED vs. BLUE.

Scope of Conflict: Accommodates airborne acquisition and fire control radar, although tracking radar is limited to detectability only. Aircraft are represented by Swirling/Barton theoretical fluctuation models.

Mission Area: Single penetrator with jammer against a single radar.

Level of Detail of Processes and Entities: Lowest entity modeled is a radar subsystem: transmitter, pulse doppler or MTI circuit, noncoherent integrator, gain control. Pulse doppler and MTI processing limited to single spectral return in user-defined filter. Target fluctuation models limited to Swerling 1-4, Chi-squared, Weinstock, and nonfluctuating. Clutter reflectivity is a user input constant.

CONSTRUCTION:

Human Participation: Not required or permitted.

Time Processing: Dynamic, closed form solution. Determines detectability of aircraft of constant heading for 0-360 degrees viewing aspect angle over a user-specified distance.

Treatment of Randomness: Deterministic; random noise sums to the mean (deterministic) over an integration period.

Sidedness: Symmetric.

LIMITATIONS: Does not model angle, range, or doppler tracking. Target fluctuation limited to models 1-4, Chi-Squared, Weinstock, or nonfluctuating.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Moving target detector (MTD: MTI followed by pulse doppler) capability and monopulse angle tracking will be added. Integration period algorithms for coherent jamming will be designed.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on VAX computer with VMS operating system.
Storage:	IPARS executable = 15,000 bytes Input files = 65,000 bytes each (including antenna patterns)
Peripherals:	No peripheral support required for operation. A graphics display terminal to view templates is recommended.
Language:	FORTRAN.
Documentation:	A user's manual and input guide are available.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Data base construction time is minimal provided that preparation is performed by a qualified radar analyst.

CPU time per Cycle: Depends on number of simulation points and radar's pulse repetition frequency (PRF). A higher PRF requires more clutter calculation. A 100 km range simulation performed at 1-degree intervals would require approximately 15 CPU minutes on a 4-MIP machine.

Data Output Analysis: Depends on level of engineering skills.

Frequency of Use: Extensive use by airframers in the analysis of low observables (LO) design.

Users: N/A.

Comments: Configuration is controlled by SAIC.

TITLE: IREM - Integrated Research, Evaluation, and System Analysis Model

MODEL TYPE: Analysis (but also being used as an exercise driver and training model).

PROPONENT: Naval Surface Warfare Center, White Oak Laboratory, Code D25, 10901 New Hampshire Ave., Silver Spring, MD 20903-5000.

POINT OF CONTACT: Jim O'Brasky, (703) 663-7369, AV 249-7369.

PURPOSE: IREM is used primarily to analyze force level assessments. It is specifically designed to investigate battle group and force level operations and to be a training model with capabilities to simulate air, surface, and subsurface platforms.

DESCRIPTION:

Domain: Land, sea, air, space, and undersea.

Span: Theater; large-scale warfare simulation.

Environment: All weather, all seasons (limited data bases).

Force Composition: N/A.

Scope of Conflict: Primarily conventional warfare and some limited nuclear weapons.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: IREM is a federation of a high level executive model (RESA) with Battle Damage Assessments (BDA) models, and LOGISTICS models, and high fidelity engagement models for each warfare area. IREM is capable of simulating on-board and off-board electromagnetic and acoustic sensors, navigation, ship and shore damage, communication networks, sensor jamming, surveillance satellites, and cruise missiles. IREM supports a two-sided interactive scenario in which opposing sides can define, structure, and dynamically control forces ranging in size from multi-carrier battle forces and associated aircraft to a single air or surface unit. It can display an "umpire's" view as well as those of the elements of the RED and BLUE command structures.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic and deterministic.

Sidedness: Three-sided, symmetric, reactive.

LIMITATIONS: Does not model naval mine warfare, striker against land targets, or amphibious warfare.

PLANNED IMPROVEMENTS AND MODIFICATIONS: IREM is being enhanced and integrated with other models into a high fidelity analysis tool, and run speed is being increased.

INPUT: Scenario, Acoustic Environment Data, Sensor Characteristics, Weather, Platform Characteristics, etc. Most of this data is in the data bases.

OUTPUT: The output consists of all the displayable information (weapon availability, damage report, detection report, communications reports, measures-of-effectiveness, etc.) available to the user via the Status Boards, Geo-Tactical Plot, and hard copy. In addition, the true position of units and tracks and the true identity of tracks are displayed on the Control Status Boards. Automated data extraction, reduction, and display features have been demonstrated.

HARDWARE AND SOFTWARE:

Computer:	Designed to run a VAX computer with a VMS operating system and connected to the IBM PCs.
Storage:	Approximately 120 MB.
Peripherals:	Minimum requirements for one Command Station: one printer, one Tektronix graphic display, one tablet, three VT100, one I/O terminal for command input.
Language:	RATFOR (Rational FORTRAN), FORTRAN 77.
Documentation:	Extensive documentation of inconsistent quality.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Population of large data bases can take several man-months to several man-years.

CPU time per Cycle: Depends on data base size, player configuration, and host computer characteristics. Large exercises can take hours of CPU time to process hours of combat. Maximum exercise rate is 6:1.

Data Output Analysis: Postprocessor aids in analysis of output. Produces hard copies of raw data, automated data reduction, and partial report generation.

Frequency of Use: Varies by command.

Users: SPAWAR 31F, NSWC D25, Navy Lab Force Assessment Community.

Comments: IREM is an ongoing project. It is being enhanced, modified, and integrated into a high fidelity analysis tool.

TITLE: IRPD - Infrared and Pulse Doppler Program

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. William McQuay, (513) 255-2164.

PURPOSE: IRPD is a research and evaluation tool that calculates the range at which a combined IR Scanning and PD Radar Warning System can detect an air- or ground-launched missile. It was designed primarily to provide input data for one-on-one engagement models between aircraft that have an IRPD warning system and missiles.

DESCRIPTION:

Domain: Land and air.

Span: Local and individual.

Environment: Many varied weather conditions.

Force Composition: One-on-one engagements.

Scope of Conflict: Conventional warfare.

Mission Area: Conventional missions involving an air- or ground-launched missile approaching a penetrator equipped with an IRPD warning system.

Level of Detail of Processes and Entities: The engagement geometry and the signature characteristics of the missile (the spectral radiant intensity as a function of aspect angle) are provided by the user. The penetrator flight path is modeled by a flight path generator. The atmospheric transmittance calculations are performed by LOWTRAN5, which is used as subroutine. Detection by the IR scanner is calculated using algorithms and subprograms from LOCNES, and the radar range equation is used to calculate the target signal strength at the radar receiver.

CONSTRUCTION:

Human Participation: Not required. Model is not interruptable.

Time Processing: Dynamic, closed form.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: The missile RCS is axisymmetric. The missile radiant intensity is axisymmetric.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: The engagement geometry and the signature characteristics of the missile; meteorological condition options.

OUTPUT: Time, range, and target irradiance when IR detection occurs; RF signa. ..ength of target at time of PD radar detection; average detection range of ta... and time to the closest point of approach and the tolerance range; closes. point of missile approach.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	18,073 bytes.
Peripherals:	Printer.
Language:	FORTRAN 77.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: March 1983.

Data Base: N/A.

CPU time per Cycle: 127 seconds (typically).

Data Output Analysis: Manual analysis of tabular results.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: ITAM - Interdiction Tanker Analysis Model

MODEL TYPE: Analysis.

PROPONENT: Boeing Military Airplanes, Operations Analysis, Box 7730, M/S K80-33, Wichita, KS 67277-7730.

POINT OF CONTACT: Frederick J. Blume, Boeing Military Airplanes, Operations Analysis, (316) 526-2956.

PURPOSE: The purpose of the ITAM is to simulate the air refueling operations involved in support of the air interdiction mission. The model is designed to optimize the tanker mix to meet differing objectives. The model will complement and become a part of the campaign simulation set.

DESCRIPTION:

Domain: Air.

Span: Global.

Environment: Altitudes and distances.

Force Composition: Attack forces and supporting tankers.

Scope of Conflict: Flights, groups, and forces.

Mission Area: Short and deep tactical interdiction.

Level of Detail of Processes and Entities: Main entities are individual aircraft (receivers and tankers). The processes modeled include aircraft flight, weapon delivery, and air refueling.

CONSTRUCTION:

Human Participation: Required to set up data files for execution. Future development of the ITAM may allow the user to interactively modify conditions in the scenario during a run.

Time Processing: Event-driven model that steps through events scheduled by input data files and by the model itself.

Treatment of Randomness: The model is deterministic.

Sidedness: One-sided.

LIMITATIONS: At the present time, theater-level operations are the limiting scenarios.

PLANNED IMPROVEMENTS AND MODIFICATIONS: A number of improvements are being considered. These include inclusion of threats in the theater and aircraft survivability based on those threats, an ability to alter the scenario interactively during a run or at specific times determined prior to run time, and improved preprocessing functions.

INPUT: Input files are required to provide the following information: location information for all origins of tankers and receivers in addition to the targets of receivers in the theater, aircraft data, and aircraft beddown data.

OUTPUT: Output will include tanker requirements, fuel offloads, fuel burns, mission feasibility determinations, and scheduling reports for tanker refueling missions, as required.

HARDWARE AND SOFTWARE:

Computer:	The model is being developed to run in a network of APOLLO DN3000 and DN660 terminals running a AEGIS-DOMAIN/IX (UNIX-based) operating system, software release 9.5.
Storage:	Unknown for the executable model. Data bases may require considerable additional space.
Peripherals:	1 printer and 1 terminal.
Language:	APOLLO/DOMAIN Pascal, APOLLO DOMAIN/IX operating system calls, and a data base management system that makes calls to Boeing Military Airplanes' Aircraft Data Base.
Documentation:	An initial methodology document are currently available.

SECURITY CLASSIFICATION: Unclassified, but data could be classified.

GENERAL DATA:

Date Implemented: ITAM is still under development.

Data Base: Development of data bases could take a considerable amount of time. We have several sets of scenario data modified from previously modeled tanker missions.

CPU time per Cycle: Unknown at this time.

Data Output Analysis: Output reports will provide a considerable amount of summary data for use in verification of mission objectives. The scheduling report will be used to verify actual tanker schedulings and missions made during the run.

Frequency of Use: Will be used on an as needed basis for air interdiction tanker analyses.

Users: Boeing Military Airplanes, Operations Analysis, Tanker/Airlift Program Support.

Comments: N/A.

TITLE: JAGUAR - Juego de Guerra Aereo Americano Regional

MODEL TYPE: Training and education.

PROPONENT: Air Force Wargaming Center (AFWC), Maxwell AFB, AL 36112.

POINT OF CONTACT: Col. T. Yax, AUCADRE/WGO, Maxwell AFB, AL 36112, (205) 293-6618, AV 875-6618.

PURPOSE: JAGUAR requires players to make the kinds of decisions an Air Component Commander, a Chief of the Tactical Air Control Center, and his senior staffs would make. It concentrates on air operations with ground and naval units and actions serving as targets and as a framework for viewing the air war.

DESCRIPTION:

Domain: Air.

Span: Two fictitious South American countries, two neutral border countries, coastal areas, and open ocean.

Environment: Day and night operations, weather, and distance factors.

Force Composition: Tactical air forces

Scope of Conflict: Conventional and low intensity warfare.

Mission Area: Conventional missions including air interdiction, battlefield air interdiction, close air support, offensive counter air, defensive counter air, special operations force insertions, electronic countermeasures, forward air control, reconnaissance, airlift, and suppression of enemy air defenses.

Level of Detail of Processes and Entities: ACC, TACC, WOC levels.

CONSTRUCTION:

Human Participation: Required for processes and analysis.

Time Processing: Game combat adjudication is based on individual ATO line time periods with the adjudication process run in batch mode to evaluate a complete combat day's input for RED and BLUE.

Treatment of Randomness: Stochastic, Monte Carlo determination on the probability of event occurrence with deterministic table lookups for combat attrition.

Sidedness: Two-sided, with BLUE and RED teams.

LIMITATIONS: Movement of ground and naval units is either done by controller or scripted.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Improved air-to-air combat including combat air patrols, escort, and defensive ground alert missions; Spanish language menus; consideration of hardening and unit size in determining attrition; logistics accounting; and data base maintenance module.

INPUT: Both RED and BLUE teams create air tasking orders containing separate line entries for each mission that include line number, aircraft type, SCL, number of sorties scheduled, originating base, target, and time period.

OUTPUT: Players can generate combat resolution reports, reconnaissance reports, SCL reports, target lists, air base lists, aircraft mission capability reports, aircraft bed-down reports, and air tasking orders. Players can also view 18 different graphs showing scheduled and unscheduled sorties for each mission type by aircraft, combat losses, maintenance, diverts, etc.

HARDWARE AND SOFTWARE:

Computer (OS):	IBM compatible MS-DOS machine with floppy and hard disk drives, 640 KB RAM, and a printer. Also requires the SMART System Spreadsheet from Innovative Software.
Storage:	340 KB for project files and basic work files plus 200 KB for each day of the war; 2 MB for SMART software.
Peripherals:	Monochrome monitor (color optional) and printer.
Language:	SMART System Project Commands.
Documentation:	User manuals available.

SECURITY CLASSIFICATION: Latin America scenario is unclassified.

GENERAL DATA:

Date Implemented: August 1988.

Data Base: About one man-month needed to rebuild data base.

CPU time per Cycle: N/A.

Data Output Analysis: Hard copy via line printer and some on-screen graphic displays. Includes special controller output report for combat resolution debugging and option for on-screen combat resolution display for each ATO line entry as it is processed.

Frequency of Use: Twice per year.

Users: Inter-American Air Forces Academy.

Comments: Managed through review and configuration control board at the AFWC.

TITLE: Janus 4

MODEL TYPE: Analysis and training.

PROPONENT: Conflict Simulation Laboratory, Lawrence Livermore National Laboratory, P.O. Box 808 L-315, Livermore, CA 94550.

POINT OF CONTACT: Jeffrey E. Pimper, (415) 422-6568, FTS 532-6568.

PURPOSE: Janus 4.0 has been used as an analysis tool to evaluate the effectiveness of new weapon systems and warfare concepts. It has also been used as a training tool, both as a command post exercise driver and as a mission plan evaluator.

DESCRIPTION:

Domain: Land and limited air units.

Span: Has been used with force sizes from squad to division level at item system resolution.

Environment: Digitized terrain from DMA or other data bases for elevation with cultural features overlay. Roads and rivers are explicitly modeled. Daytime and limited nighttime play are modeled. Weather can be changed but remains constant during game play.

Force Composition. Joint and combined forces, both RED and BLUE.

Scope of Conflict: Conventional, advanced conventional, beam and nuclear weapons, and limited chemical effects.

Mission Area: All conventional land operations.

Level of Detail of Processes and Entities: Up to 500 units per side, each composed of 1 to 15 homogeneous item systems. Acquisition is performed at the unit level but attrition is done at the item system level. Attrition is stochastic. Logistics and resupply can be played.

CONSTRUCTION:

Human Participation: Janus 4.0 can be used with or without human participation. With human participation, up to 16 players can freely interact with their units during the game. The human player performs all planning functions. Without human interaction, a preplanned scenario may be played in batch mode. The model is interruptable on a fixed time step and may then be reinstated in either mode.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Does not explicitly model sea assets or air-to-air combat. Limited to 500 units per side and 99 different system types per side. Terrain resolution limited to 400 x 400 cells, but the cells may be of arbitrary size. Uses simple models for chemical effects and engineering obstacles.

PLANNED IMPROVEMENTS AND MODIFICATIONS: New, faster, and more accurate line-of-sight process; additional advanced conventional munitions; and more detailed engineering and chemical models.

INPUT: Terrain file, pH/pK file, user-defined symbol file, and scenario file that contains all system and unit characteristics, coefficients and parameters used by the algorithms in the model, and unit orders and plans.

OUTPUT: Players sitting at graphic workstations displays, which are continually updated during the game play, can request various status and spot reports at that time. Status, spot, and event data may be written to disk during game play for later postprocessing.

HARDWARE AND SOFTWARE:

Computer:	Any VAX computer, from VAXstation 2000 through VAX 8800. Uses the VMS 5.0 operating system.
Storage:	Minimum requirement: 100,000 blocks. Large scenarios may generate large output files, up to an additional 100,000 blocks.
Peripherals:	Minimum requirement: one Tektronix 4225 workstation (two required for 2-sided game play) with one graph tablet and one VT100 or compatible terminal. Can expand up to eight workstations with two graph tablets each. Printer not required but many printed reports are available.
Language:	VAX FORTRAN.
Documentation:	Janus 4.0 Users Manual and Janus 4.0 Algorithms Document.

SECURITY CLASSIFICATION: Unclassified, but data bases may be classified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Creating new data bases can take from one man-day to one man-month depending on size and complexity.

CPU time per Cycle: Scenario-dependent.

Data Output Analysis: The user determines which spot, status, and data are to be output to disk. Some reports can be printed, while the rest may be read into a relational data base management system for postprocessing.

Frequency of Use: Varies by installation.

Users: Lawrence Livermore National Laboratory, SOUTHCOM, Institute for Defense Analysis, Canadian National Defense Headquarters, Atomic Weapons Establishment in Britain, Command and General Staff College, Battle Simulation Center Ft. Lewis, USAICS Ft. Huachuca, USMC Quantico, and several others.

Comments: Developed and managed by Lawrence Livermore National Laboratory. Installation under site-specific MOA at government-approved sites. Source files are not distributed to users. Continually upgraded based on user requests.

TITLE: JANUS/R

MODEL TYPE: Analysis.

PROPONENT: BGWG Section, CA4 Division, R.A.R.D.E. Fort Halstead, Kent, England, UK.

POINT OF CONTACT: I.S. GARDNER, CA4 RARDE Fort Halstead, Kent, UK.

PURPOSE: JANUS/R is a research and evaluation tool that deals primarily with weapon systems development and effectiveness. It an also be used to assess force capability and requirements, dealing with courses of action, mix, effectiveness, and resource planning.

DESCRIPTION:

Domain: Land and air/land.

Span: Local.

Environment: Digitized terrain consists of data for each 50-meter square. Terrain features include spot heights, seven types of vegetation, seven types of building, rivers, roads, bridges, and obstacles. The model can handle any time of day in any weather conditions.

Force Composition: Up to brigade level.

Scope of Conflict: Conventional.

Mission Area: Any conventional missions within the domain.

Level of Detail of Processes and Entities: The lowest entities modeled are individual men, vehicles, or aircraft, although men are usually grouped into small teams. Attrition, movement, target acquisition, and logistics are modeled for each entity.

CONSTRUCTION:

Human Participation: Required for decisions, although the model will continue to run without a decision.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Does not model C3I in any detail.

PLANNED IMPROVEMENTS AND MODIFICATIONS: A more detailed mobility model and an increase in the number of mine types are planned immediately. Approximately 30 other changes to be made have been identified.

INPUT: Terrain data, weather data, system and weapon characteristics including attrition data, mobility data and activity timings, and smoke and dust data.

OUTPUT: System status as requested during the game. Records of all direct fire and indirect fire events, mine encounters, and detections can be printed.

HARDWARE AND SOFTWARE:

Computer:	VAX series from microVAX to VAX 8700 with a VMS operating system.
Storage:	100 MB.
Peripherals:	RAMTEK 9400 series graphics device with a 19-inch monitor, a data tablet, a four-button puck, and a key pad; a high-speed line printer; and peripheral VT100 terminals.
Language:	FORTRAN.
Documentation:	N/A.

SECURITY CLASSIFICATION: Code is unclassified and data base as sent is unclassified (there is a classified key).

GENERAL DATA:

Date Implemented: 1987.

Data Base: If the data base is in the file, as most are, it takes minutes. Completely new data bases may take man-weeks.

CPU time per Cycle: Runs at ratio of 1 minute of game time to 3 minutes of real time.

Data Output Analysis: Killer-victim score boards, engagement range analysis, force exchange ratios, and loss exchange ratios.

Frequency of Use: Daily.

Users: R.A.R.D.E.

Comments: N/A.

TITLE: JANUS(T)

MODEL TYPE: Analysis (has been used as exercise driver and training model).

PROPONENT: Brigade/Battalion Interactive Simulation Division, Combat Simulation Directorate, TRAC-WSMR, White Sands Missile Range, NM 88002-5002.

POINT OF CONTACT: Mr. C. Lee Kirby, (505) 678-4949, AV 258-4949.

PURPOSE: JANUS(T) is a combat developments tool. It is an interactive, near-real-time model developed to explore the relationships of combat and tactical processes. Players make doctrinal and tactical decisions, deploy forces, develop scenarios, and make and execute plans.

DESCRIPTION:

Domain: Land, air, and sea.

Span: Can accommodate any locale, depending upon data. Normally battalion and brigade operations are conducted.

Environment: Data dependent. Three-dimensional terrain with added information representing roads, rivers, towns, and vegetation. Temperature, humidity, and wind direction are also utilized. Operations can be conducted in daytime, night, or under reduced visibility conditions.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Virtually all weapons found on current or proposed battlefields can be portrayed. Primarily directed towards conventional warfare but has limited chemical portrayal.

Mission Area: Conventional and low-intensity conflict can be represented.

Level of Detail of Processes and Entities: Individual soldier or individual system is lowest entity modeled. Conventional direct fire from both ground and air systems is automatic and dependent on line-of-sight, probability of acquisition, response time, reload rates, range, and posture of firer and of the target. The player has the ability to mount and dismount forces on vehicles. The model also supports detailed play of precision-guided munitions such as COPPERHEAD, HELLFIRE, and FOG-M. Obstacles, natural and man-made, are represented as are smoke, artillery dust, plus radar and conventional optical and IR sensors. Chemical alarms and performance degradation due to MOPP have been incorporated. Conventional mines plus air, ground, and artillery-delivered scatterable mines are played in detail including the capabilities to breach, bull, or bypass these obstacles.

CONSTRUCTION:

Human Participation: Required to make a number of game decisions.

Time Processing: Dynamic, event-sequenced model.

Treatment of Randomness: All elements of ground, air, and sea combat are treated stochastically. Outcomes of events occur according to the laws of probability and change.

Sidedness: Two-sided, asymmetric model with both sides reactive.

LIMITATIONS: Area fire of direct fire weapons is not assessed; illumination rounds are not played; and nuclear phenomena such as dazzle, induced radiation fallout, and EMP effects are not currently assessed.

PLANNED IMPROVEMENTS AND MODIFICATIONS: An interactive MOUT capability, heterogeneous aggregation of forces, and the ability to run the model in a systemic mode are currently being worked upon. Additional enhancements to "smart" weapons capabilities and to automatic functions, such as dismounting, are planned for addition to the model.

INPUT: Phenomenology data types for weapons characteristics and effects, sensor characteristics, mine characteristics, flyer and radar data, terrain information, and forces information are all required inputs to the model.

OUTPUT: Produces a hard copy output of game statistics, artillery summaries, direct fire reports, range analyses, detection tables, and killer-victim scoreboards. Also provides a graphical replay and rerun capability.

HARDWARE AND SOFTWARE:

Computer:	VAX computer with a VMS operating system.
Storage:	5 MB central memory and 456 MB mass storage.
Peripherals:	Two RAMTEK 946X or two Tektronix 4125 workstations (proliferation package has four RAMTEK workstations), one graph tablet and puck per workstation, one printer, one VT-220 per workstation.
Language:	VAX-11 FORTRAN.
Documentation:	JANUS(T) documentation published June 1986.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1983.

Data Base: Creating a data base from scratch, when data is available from data sources, requires approximately two weeks to build and check. For normal study requirements, when only data base modifications are necessary, approximately two days are needed.

CPU time per Cycle: N/A.

Data Output Analysis: Postprocessor, hard copy and graphics, aids in analysis of output. Analysis of each game requires approximately 1/2 hour.

Frequency of Use: Varies by user, but is used at least several times per year by those users listed below.

Users: TRAC-WSMR, TRAC-FLVN, Ft. Benning, Ft. Knox, Ft. Rucker, Ft. Sill, TRAC-MTRY, RAND, RARDE (UK).

Comments: Continually upgraded based upon requirements and priorities established by study proponents. TRAC-WSMR is configuration control agency and the model is managed through a Model Resources Group chaired by HQ, TRAC.

TITLE: JAWS - Joint AFSC Wargaming System

MODEL TYPE: Training and education.

PROPONENT: National Defense University, Armed Forces Staff College, 7800 Hampton Boulevard, Norfolk, VA 23511-6097.

POINT OF CONTACT: CDR H. L. Shotwell, (804) 444-5100, AV 564-5100.

PURPOSE: JAWS is used primarily to test the student's TPTRL and operation plans. It serves as both an operations support and a force capability assessment tool for mixes of forces or resources.

DESCRIPTION:

Domain: Land, sea, and air at about equal resolution.

Span: Depends on data base.

Environment: Hex-based. Discrete terrain and transportation factors must be chosen for each hex. Models day and night operations and different degrees of weather constant throughout the theater. Models roads, rivers, and transportation barriers.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional weapons.

Mission Area: Conventional; AFSC scenarios emphasize amphibious joint missions.

Level of Detail of Processes and Entities: The players give orders to units to initiate activities. Certain processes, such as air defense or withdrawal, are activated automatically. Ground attrition results are based on Lanchester coefficients. Air and naval engagements are based on probability of kill and Monte Carlo techniques. Pending event lists are maintained to control discrete events and processes.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Processes and pending events occur at a controller-specified ratio of exercise time to real time.

Treatment of Randomness: Land attrition deterministically based on Lanchester coefficients. Air, naval, and convoy attrition assessed through Monte Carlo techniques. Pending event lists are maintained to control discrete events and processes.

Sidedness: Two-sided, asymmetric, reactive. RED can be fully or partly automatic. Control can override any event or process.

LIMITATIONS: Aggregated level of detail for land, sea, and air operations.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Z-248 or IBM PC workstations are being implemented for ground operations, naval, logistics, and intelligence. The workstations can be used with either the micro or the mainframe version of JAWS.

INPUT: Scenario data base. Orders from gamers and control.

OUTPUT: Printouts of movement, attrition, intelligence, and logistic data as well as postprocessor statistics.

HARDWARE AND SOFTWARE:

Computer:	IBM, VAX, or CDC mainframe. Z-248 or IBM-pc microcomputers with 640 Kbyte memory.
Storage:	At least 10 MB hard disk drive.
Peripherals:	Two printers and two terminals or PCs for order input.
Language:	FORTRAN and "C."
Documentation:	Four programmer manuals and three gamer manuals.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1982.

Data Base: New scenario can take several man-months. Automatic programs are available to convert Joint Theater Level Simulation terrain to JAWS terrain.

CPU time per Cycle: Runs at ratio of simulated time to real time.

Data Output Analysis: End-of-game statistics. Games can be rerun from archived, time-tagged order input files.

Frequency of Use: 16 games per year.

Users: AFSC and NDU-INS-WGSC.

Comments: Source code maintained at NDU-INS-WGSC and AFSC.

TITLE: JAWS - Joint Analytic Warfare Systems

MODEL TYPE: Analysis.

PROPONENT: Force Structure, Resource and Assessment Directorate (J-8), The Joint Staff, The Pentagon, Room 1D929, Washington, DC 20318-8000.

POINT OF CONTACT: Peter C. Byrne, (202) 697-7824, AV 227-7824.

PURPOSE: JAWS is used for joint and combined sea, land, and air forces capabilities assessments regarding force mix, effectiveness, resources, strategy, weapons, and doctrine.

DESCRIPTION:

Domain: Sea, land, and air combat.

Span: JAWS is variable in scale from regional to global multi-theater.

Environment: Environmental effects in initial naval version represented by indexing sensor performance data on environmental conditions. The improved version planned for spring 1989 will expand environmental features to address naval movement near islands, polar ice, canals, etc.

Force Composition: Joint and combined forces.

Scope of Conflict: The initial naval version of JAWS represents conventional naval weapons. Full JAWS will represent conventional, chemical, nuclear, and unconventional warfare for sea, land, and air forces.

Mission Area: The course of combat in JAWS is driven by planning and (C2) features that allow representation of many different mission areas.

Level of Detail of Processes and Entities: Level of detail is variable depending on the choice of entity data and process algorithms chosen from the JAWS knowledge base for a particular game. Current knowledge base used in J-8 supports individual C2 entities (e.g., light helicopter squadron 4) embarked on individual ships and submarines with resolution of individual equipment (e.g., AN/spg 62 illuminator); and supplies (e.g., sailor). Initial version of JAWS represents the following processes: naval air, surface, and submarine warfare; C2; communications; disposition; and combat intelligence. The planned improved version will add mine warfare, electronic countermeasures, deception, environment, long-term intelligence fusion, and worldwide deployment. Tactical decisions made by a C2 entity in a JAWS model run are determined by entity's C2 plans passed down from above and by the entity's own perceptions from available sensor data.

CONSTRUCTION:

Human Participation: Not required for the initial version. Improved version will allow optional human intervention at day boundaries.

Time Processing: Dynamic, time-step and event-step.

Treatment of Randomness: Basically deterministic; produces expected value results in a single run with no randomness.

Sidedness: N-sided, symmetric.

LIMITATIONS: The current version addresses naval warfare only, as does the planned update. Incremental updates planned for 1990-1992 will complete the knowledge base for ground and air warfare.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Graphical interface, UNIX-based version, and more increments of new functionality planned through 1992.

INPUT: JAWS user interface prompts the user to select a subset of the data and process descriptions stored in the JAWS knowledge base. If not satisfied with the choices, the user can also select from new knowledge base data.

OUTPUT: User-variable amount of raw data in relational form during a game is recorded. Through the user interface, one can either perform direct INGRES SQL queries against this raw data or choose from a list of standard reports (e.g., killer/victim summary, chronological event list, or plan trace). System also produces user-variable amounts of diagnostic output as desired.

HARDWARE AND SOFTWARE:

Computer:	Currently runs under VAX VMS. System was designed to be as hardware-independent as possible.
Storage:	A game execution requires approximately 3000 blocks of main memory and approximately 33,000 blocks of virtual memory. A test game with three waves of backfires against a carrier battle group produced 20,000 blocks of output with an additional 500 blocks of diagnostic message files.
Peripherals:	Currently configured to be run from a DEC VT100.
Language:	Programmed in "C" and uses INGRES.
Documentation:	A complete set of DOD-STD-7935 documentation is available.

SECURITY CLASSIFICATION: JAWS is unclassified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Several staff-years to populate and maintain knowledge base.

CPU time per Cycle: The test game (1 simulated day of activity) described above required approximately 20 minutes of CPU on the J-8 VAX 8650.

Data Output Analysis: Dynamic queries and standard reports are provided.

Frequency of Use: Currently being tested by J-8 for later operational use.

Users: JCS/J 8; DCA/JDSSC/C315; Logicon, Inc.; and Argonne National Laboratory.

Comments: JAWS is being developed in increments: first naval, then ground support, then the rest of air. The initial naval modeling capability is currently operational.

TITLE: JC3S - Joint C3 Simulation

MODEL TYPE: Analysis.

PROPONENT: Joint Director of Laboratories (JDL), Technical Panel for C3.

POINT OF CONTACT: Mr. J. Tremlett, RADC/CO-1, (315) 330-7285, AV 587-7285.

PURPOSE: JC3S is a research and evaluation tool that deals with systems development and effectiveness. It provides enhancements to the RESA model that includes more representative modeling of air and land component forces, terrain features, and their interactions.

DESCRIPTION:

Domain: Air, land, sea, and undersea.

Span: Accommodates any theater depending on data base; terrain feature and land forces data bases currently available for Central Europe only.

Environment: DTED Level II terrain data base with roads, rivers, cities, political boundaries, and barriers modeled.

Force Composition: Joint forces, BLUE and RED.

Scope of Conflict: Primarily conventional warfare (RED and BLUE), limited electronic combat, and very limited nuclear and chemical effects possible.

Mission Area: Conventional naval mission areas modeled in RESA augmented by air interdiction, close air support, and other air-land battle conventional missions.

Level of Detail of Processes and Entities: Ground units currently modeled at the battalion level. Aircraft flights modeled individually. Surface and subsurface platforms modeled. Ground unit movement currently road-constrained. Off-road movement is being implemented. Detection and identification of enemy units model utilizes line of sight, range, and target cross section. Engagement outcome determined by rules of engagement, weapons payload, and attrition models. Logistics and communications are modeled.

CONSTRUCTION:

Human Participation: Not required, but when used for decisions and processes it significantly enhances realism.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Visual and radar detection models and damage model are deterministic. See RESA description for other models.

Sidedness: Two-sided, symmetric, reactive.

LIMITATIONS: Geographic and forces data bases for land forces limited to Central Europe. Scenario complexity limited by processor memory and speed. Off-road movement model and force-on-force engagement modeling limited.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Expanded data bases for theaters worldwide, ground movement, and engagement model enhancements.

INPUT: Scenario input requirements include unit definitions, initial deployment positions, destinations, and other actions to be taken (initial orders).

OUTPUT: Produces graphic display of scenario activity and movement, numerous alphanumeric status boards for RED and BLUE units, and event data files suitable for post-game analysis. Postprocessor available to help analyze output.

HARDWARE AND SOFTWARE:

Computer: DEC VAX series of computers with VMS operating system V4.7 or higher.

Storage: 400,000 blocks disk storage required for source, executable, scenario, and cartographic data.

Peripherals: Tektronix 4125 Color Graphic Display, and VT100 (or equivalent) alphanumeric terminals.

Language: Rational FORTRAN (RATFOR) and some Pascal.

Documentation: Software design document, software product spec, software user's manual, technical report (also see RESA).

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1989.

Data Base: Weeks or months, depending upon scenario scope.

CPU time per Cycle: Depends on number of entities, complexity of scenario, and number of players. Can be in excess of 30 minutes processing time for 3 minutes elapsed in scenario on small VAX processor.

Data Output Analysis: Postprocessor assists in analysis of recorded events.

Frequency of Use: Data not yet available, but frequency of use anticipated to be several times per year.

Users: NOSC Code 454, U.S. Army CECOM AMSEL-RD-C3-AF, and RADC/CO.

Comments: JC3S derived directly from RESA and DGTS models.

TITLE: JESS - Joint Exercise Support System

MODEL TYPE: Training and education.

PROPONENT: Joint Warfare Center (JWC), Hurlburt Field, FL 32544.

POINT OF CONTACT: MAJ David E. Kendrick, (904) 884-7747, AV 579-7747.

PURPOSE: JESS is a computerized, automated CPX driver designed to aid in training Tactical Air Control Center, corps, division, and brigade staffs.

DESCRIPTION:

Domain: Land and air with limited naval functionality.

Span: Theater or regional terrain; four terrain data bases completed (Central America, Central Europe, Korea, and Southwest Asia). Terrain playbox size limited to three contiguous UTM zones due to mathematical constraints.

Environment: Hex-based (3 km hexes). Hex characteristics include trafficability, elevation, roughness, roads, chemical or nuclear contamination, fortifications, vegetation level, and urban level. Hex edge characteristics are rivers, barriers, obstacles, and bridges. Models time of day, sunrise and sunset, and during exercises is run in real time. Weather is limited to chemical effects.

Force Composition: Joint and combined forces, RED and BLUE.

Scope of Conflict: Virtually all conventional, chemical and nuclear, ground and air weapons and their effects, and logistics are fully integrated.

Mission Area: All conventional missions and limited special operations.

Level of Detail of Processes and Entities: Initial unit resolution is RED regiment, BLUE battalion, and individual sortie for air. JESS allows dynamic task organization and unit creation at the battalion- and separate company-level of BLUE forces. Operates with stochastic attrition using heterogeneous Lanchester and fractional damage. The major functional areas of ground, air, logistics, and intelligence are totally integrated. The software provides an automated interface to the Tactical Simulation (TACSIM) to provide national and strategic intelligence.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-step. Uses a ratio of user-specified exercise time to real time.

Treatment of Randomness: N/A.

Sidedness: Two-sided, asymmetric, both sides interactive.

LIMITATIONS: Naval functionality limited to naval gunfire support and carrier air strikes.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Air-to-air/air-to-ground, automated ATO generator, Round Robin airlift, JAAT, multiple simultaneous missions for batteries, two-stage engineer tasks, convoy capabilities, increased engineer capabilities, and intelligence from helicopter missions.

INPUT: Orders and information requests (more than 72 orders and 15 reports available).

OUTPUT: Printouts of movements, attrition, intelligence, and logistics.

HARDWARE AND SOFTWARE:

Computer:	Suite of 14 interconnected computers and a variety of peripherals. VAX 8600 minicomputer, one MicroVAX II Gateway Processor, and 13 or more MicroVAX II microcomputers.
Storage:	VAX 8600 has 128 MB of RAM. Major peripherals have one HSC 50 Hierarchical Storage Controller, three RA81 456 MB disk subsystems, one RA 60 205 MB disk subsystem (removable disk), one RL02 console terminal with 10.4 MB disk, one TA78 tape drive (1600/6250 BPI), one Printronix 600 high-speed printer, and one H4000 EtherNET transceiver.
Peripherals:	MicroVAX II computer with 17 MB of RAM and three 71 MB internal disks. Each MicroVAX II supports one to three user workstations. Major peripherals per workstation include two DEC VT200 alphanumeric terminals, one GTCO coordinate digitizing pad, one Sony laser videodisk player, two Sony color graphics monitors, one DEC LA210 dot matrix printer, and one GraphOver 9500 overlay generator.
Language:	Highly stylized version of SIMSCRIPT II.5 (processed by the SDDL for readability).
Documentation:	Twenty-one manuals to be published in December 1988.

SECURITY CLASSIFICATION: Unclassified, but data base is often classified.

GENERAL DATA:

Date Implemented: November 1985 (JESS 1.0), December 1988 (JESS 1.1).

Data Base: Six months (modifications-scope dependent).

CPU Time per Cycle: Depends on data base size, player configuration, and amount of conflict and distance of convoys.

Data Output Analysis: JESS is not an analysis tool but may identify areas worthy of further inspection. A postprocessor is not available.

Frequency of Use: Varies by command; usually constricted by data base construction times.

Users: JWC, Combined Arms Center, Battle Command Training Program, and I, III, V, VII, XVII Corps.

Comments: None.

TITLE: JPLAN - Joint Planning Exercise
RADEX - Rapid Deployment Exercise

MODEL TYPE: Training and education.

PROPONENT: Air Force Wargaming Center, Maxwell AFB, AL 36112.

POINT OF CONTACT: Col. T. Yax, AUCADRE/WGO, Maxwell AFB, AL 36112, (205) 293-6618, AV 875-6618.

PURPOSE: JPLAN and RADEX, seminar exercise drivers, support deployment planning exercises. Each highlights the complexities and problems associated with planning the deployment and sustainment of large force packages over long distances. Players apply basic JOPS concepts when developing a force list within the constraints of limited lift and port capabilities. Players assign movement, timing, and priority. A TFE provides feedback on the feasibility of the plans within established constraints.

DESCRIPTION:

Domain: JPLAN: air.
RADEX: air and sea.

Span: Theater level.

Environment: Global movement from CONUS to theater of operations.

Force Composition: Joint forces by both the Military Airlift Command and Civilian Reserve Air Fleet. RADEX adds sealift as a deployment method.

Scope of Conflict: Conventional response to theater crisis.

Mission Area: Focus on force and deployment planning. They model strategic airlift and sealift (RADEX only) and CRAF.

Level of Detail of Processes and Entities: Deployment units are of squadron size or larger. Certain specialized units may deploy in smaller units. The user may adapt the model for smaller units.

CONSTRUCTION:

Human Participation: Required for decisions and processes only. Players must make decisions before running the simulation (TFE).

Time Processing: Static.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: JPLAN and RADEX do not model geography. Airlift is one sortie per day regardless of actual distance. Sealift (RADEX only) uses reasonable sailing times. Number of air bases, seaports, lift platforms, and units deployed are restricted by the hardware environment (i.e., disk capacity and memory).

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Data base includes UTC and UTC data, airbase and airbase limitations, and airlift aircraft and aircraft limitations. For RADEX only, the data base includes seaport and seaport limitations and sealift and sealift limitations. Players must input the Unit UTCs requested for deployment and deployment priority, airbase priority, and seaport priority (RADEX only). Game developers may establish game parameters in accordance with user requirements.

OUTPUT: The TFE supplies several types of printed reports to aid the student in shortfall resolution. In all, up to 40 different reports are provided.

HARDWARE AND SOFTWARE:

Computer (OS):	IBM compatible MS-DOS machine with 10 MB hard disk drive storage and 640 KB RAM (minimum 2 MB recommended). Also requires the INGRES PC data base management system run time environment.
Storage:	7.8 MB for executable and 1.5 MB for disk work space.
Peripherals:	Monochrome monitor (color optional) and printer.
Language:	MS-C, SQL, and the INGRES 4GL.
Documentation:	User and maintenance manuals available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: February 1988.

Data Base: Up to 10 man-weeks needed for complete data base change.

CPU time per Cycle: N/A.

Data Output Analysis: Performed by players.

Frequency of Use: Used annually by their respective users.

Users: JPLAN: Air Command and Staff College (ACSC).
RADEX: Air War College.
AUCADRE and AFWC have used variations.

Comments: Managed through the review and configuration control board at the AFWC.

TITLE: JTIDSC2 - Joint Tactical Information Distribution System Class 2 Terminal Network Simulation Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Electronic Proving Grounds, ATTN: [STEEP-(T-E)], Fort Huachuca, AZ 85613-7110.

POINT OF CONTACT: Mr. Steven C. Cooper, (602) 538-4953, AV 879-4953.

PURPOSE: The JTIDSC2 model is an operational support tool (decision aid). It is used to estimate the communication performance of JTIDS networks when deployed in the complex electromagnetic environments expected to occur in tactical situations, including the performance under various conditions of deployment geometry and threat characteristics.

DESCRIPTION:

Domain: Land, air, and limited space and naval.

Span: Accommodates any theater depending on data base. Can model individual equipment to full corps and above deployments.

Environment: Detailed RF phenomenology model. Models the effect of terrain and ground constraints in either an area prediction or point-to-point mode. Options are available to use DMA digitized terrain data as input. Effects of time of day, month, and climatology considered for various propagation models.

Force Compositic Joint and combined, BLUE, GREY, and RED.

Scope of Conflict: Con tional warfare.

Mission Area: All phases of conventional warfare.

Level of Detail of Processes and Entities: JTIDSC2 uses deployment data concerning the location, terrain, and required linking of communications and electronics equipment contained in a tactical force. System processes that are modeled include packet initialization, message packet reception, receive and process acknowledgement packet, send message packet, and transmission failure.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, containing both Monte Carlo and direct computation processes.

Sidedness: Not applicable.

LIMITATIONS: Does not model specific effects of foliage or urbanization.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Propagation modules are under study for enhancement plus computer graphical development for file updates, data validation, and model output presentations.

INPUT: Tactical deployment data, equipment technical performance characteristics, propagation path loss parameters, and message traffic data.

OUTPUT: Message error rate/throughput for test system terminals, message transmission times, and message failure statistics. Output data presentations suitable for statistical postprocessing.

HARDWARE AND SOFTWARE:

Computer:	CYBER 180 Model 830.
Storage:	Variable; requirements can be adjusted.
Peripherals:	Optimum number of disk and tape drives varies; variable mass storage requirements in size of data files determine requirements.
Language:	SLACS 5 (an extended FORTRAN 77).
Documentation:	Extensively documented.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:
Date Implemented: 1984.

Data Base: Preparation of complete new corps-size deployment with appropriate RED forces requires one year. Analysis requiring data modification for specific test system requires one or two months depending on system.

CPU time per Cycle: Depends on deployment size and number of equipment to be evaluated. Corps-size deployment can take 100 hours of CPU time.

Data Output Analysis: Hard-copy printouts, disk, and files.

Frequency of Use: Last analysis performed in 1986.

Users: USAEPG. Numerous analyses have been performed for a variety of government agencies.

Comments: The model is not machine dependent. It does, however, take advantage of the CDC CYBER 60-bit word for optimizations of data storage and access, and would require modification for other environments.

TITLE: JTLS - Joint Theater Level Simulation

MODEL TYPE: Analysis (but has been used as an exercise driver and training model).

PROPONENT: Joint Warfare Center, Hurlburt Field, FL 32544.

POINT OF CONTACT: Maj Bob Kloecker, (904) 884-6926, AV 579-6926.

PURPOSE: JTLS is used primarily to analyze theater-level operations plans. It is designed to serve as both an operations support and a force capability tool to assess the value of different mixes of forces or resources. The model also has been used as an exercise driver.

DESCRIPTION:

Domain: Land, air, and limited naval operations with full intelligence and logistics possible.

Span: Graphics utilization limited by the availability of JTLS video disks (including Caribbean basin, Southwest Asia, Central America, Europe, Korea, and Japan). Unit data bases have been compiled for Korea, Central America, Europe, and Southwest Asia.

Environment: Hex-based. Hexes may vary in size between data bases but not within one data base. Hex characteristics include trafficability, elevation, roads, and chemical or nuclear contamination. Models time of day and three different degrees of weather. Models railroads, rivers, and transportation barriers.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Primarily conventional but some limited nuclear and chemical effects possible.

Mission Area: Conventional air, ground, and naval missions; effects of special operations can be modeled.

Level of Detail of Processes and Entities: Data base defines unit size and combat systems represented. Thirteen different operational unit sizes can be represented. Ground attrition is based on Lanchester coefficients as modified by environment and terrain. Losses are assessed against units on a data base-defined period. Air attrition is assessed by probability of kill with output as individual aircraft kills. Missions are composed of single sorties, multiple aircraft, or multiple packages as dynamically called for during scenario execution. Naval ships are modeled as individual units. Attrition occurs based on vulnerability remaining versus number of hits taken. Amphibious oerations are explicitly modeled.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, event-step; user-specified ratio of exercise time to real time.

Treatment of Randomness: Deterministic land attrition uses Lanchester-based methodology. Air and naval attrition stochastically based on direct computation of probability of both detection and kill, with Monte Carlo determination of result.

Sidedness: Two-sided, asymmetric (both sides are interactive).

LIMITATIONS: Does not model naval mine warfare, undersea operations, special operations, or land-based cruise missiles.

PLANNED IMPROVEMENTS AND MODIFICATIONS: User requirements for a revised Postprocessor function are being developed. Completion of the INGRES-based Scenario Development System and the Information Management Terminal, dynamic creation of units, automated ATO generator, and SUN graphics capabilities are scheduled for FY89.

INPUT: Takes relevant terrain, weapons, movement, attrition tables, unit characteristics, and TPFDD information as input.

OUTPUT: Produces printouts of movement, attrition, intelligence, logistic data, and unit status.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on VAX 8600 series using the VMS operating system; Microvax II operation is possible.
Storage:	240,000 blocks (122 megabytes) needed before data base installed.
Peripherals:	Minimum requirements: 1 printer, 1 graphic suite, and 4 VT100 terminals.
Language:	SIMSCRIPT II.5, "C," DCL, and INGRES.
Documentation:	Extensively documented with 13 published manuals.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1983.

Data Base: Complex, time-consuming development process due to the extensive information required.

CPU time per Cycle: Dependent on data base size, scenario complexity, and hardware configuration.

Data Output Analysis: Produces hard copies of raw data.

Frequency of Use: Varies by command.

Users: USCENTCOM, USEUCOM, USSOUTHCOM, Joint Warfare Center, AUCADRE, Army War College, and Naval Postgraduate School, and Combined Forces Command/KOREA.

Comments: A configuration board made up of representatives of all users manages model and establishes priorities for model enhancement.

TITLE: Kinematics

MODEL TYPE: Training and education (support of war games).

PROPONENT: Wargaming Department, Naval War College.

POINT OF CONTACT: Micromodels Manager, (401) 841-3276, AV 948-3276.

PURPOSE: Kinematics displays user-specified geographical areas and keeps track of user-specified ship and formation movement and fuel usage. It is designed to provide graphic support for seminar war games.

DESCRIPTION:

Domain: Land and sea.

Span: Regional.

Environment: Geographic depiction of land and sea boundaries.

Force Composition: BLUE and RED naval forces.

Scope of Conflict: No conflict.

Mission Area: None. Shows geographic location of forces.

Level of Detail of Processes and Entities: Displays ships, formations, land and sea borders, and seaports. Moves ships and formations in user-specified time steps according to user input of movement plans.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic, time-step model.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, symmetric.

LIMITATIONS: User input-intensive.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None anticipated.

INPUT: Geographic area, seaport location, ship and formation specification, movement plans, and fuel status.

OUTPUT: Graphic display of ship and formation locations, reports of location, and fuel usage and availability.

HARDWARE AND SOFTWARE:

Computer: IBM-compatible PC with 512K RAM and dual 360K floppy drives.
Storage: N/A.
Peripherals: Printer (program will not run without printer).

Language: "C."
Documentation: User's manual, design description, and source code.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1988.

Data Base: One hour for moderately detailed scenario.

CPU time per Cycle: 10 seconds.

Data Output Analysis: None.

Frequency of Use: None to date.

Users: Wargaming Department, Naval War College.

Comments: Kinematics is designed to be used in conjunction with the Strike and Surface-Air Battle models. Data bases are compatible. User should be able to move freely among all three models. Kinematics alone is merely a device to administratively keep a plot of ship locations.

TITLE: LABS - Local Air Battle Simulation

MODEL TYPE: Analysis.

PROPONENT: McDonnell Douglas Corporation, McDonnell Aircraft Company, P.O. Box 516, St. Louis, MO 63166.

POINT OF CONTACT: Stephen L. Chan, (314) 233-8283 or Barbara J. Vogel (314) 777-7310.

PURPOSE: LABS is a research and evaluation tool that simulates air-to-air combat with up to 24 aircraft applying different tactics to a variety of missions. It also evaluates the effectiveness of variations in the design of aircraft, air weapons, and avionics.

DESCRIPTION:

Domain: Air.

Span: Local through mission level.

Environment: All altitudes, clouds, clear weather, ECM, and no-ECM.

Force Composition: Up to 24 fighters and bombers in raids and defensive elements.

Scope of Conflict: Conventional warfare.

Mission Area: Beyond visual range through close-in air-to-air combat.

Level of Detail of Processes and Entities: Entities include aircraft, missile, gun, radar, sensor, other electronic systems, and pilot. Processes include aircraft and missile flight, propulsion, and control; C3I and multiple sensor integration; pilot risk; and attrition.

CONSTRUCTION:

Human Participation: Interactive mode requires human participation for pilot decisions. Model waits for human responses. Batch mode does not require on-line participation, but uses predefined tactics and rules.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Choice of stochastic (Monte Carlo) or deterministic (expected value approach).

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: 24 aircraft, 10 typ

PLANNED IMPROVEMENTS AND MODIFICATIONS: Real-time operations and expert system applications.

INPUT: Weapon system definition data:

- Aircraft (aero and propulsion tables, armament types and loadings, infrared (IR) signature tables, maximum-energy climb profiles).
- Radar (antenna gimbal limits, single-scale probability of detection tables, sweep rate and bar spacing, and antenna pattern).
- Missile (aero and propulsion tables, trajectory profiles, seeker type, seeker limits).
- ECM (jammer type and power and pattern).
- Tactics (maximum acceptable loss rate, attack altitude profile, disengagement altitude profile, load factor for attack and disengagement, and radar scan setting).

Initial flight states and geometry:

- Number of aircraft.
- Position.
- Speed.
- Heading.

Termination condition (currently time limit).

OUTPUT: Summary of engagement outcomes, event ledger (time history of key events), graphical display of aircraft and missile flight path, and graphical display of selected state variable time histories.

HARDWARE AND SOFTWARE:

Computer (OS):	DEC VAX (VMS), CDC Cyber 175/176 (NOS).
Storage:	VAX: 1 MB. CDC: 350 K8 words.
Peripherals:	Tektronix 4014/4016 terminal and 4631 hard copy unit.
Language:	FORTRAN.
Documentation:	Local Air Battle Simulation (LABS) Users Manual, January 1982, and annual IRAD project descriptions.

SECURITY CLASSIFICATION: Unclassified and secret versions.

GENERAL DATA:

Date Implemented: 1979.

Data Base: Approximately one week.

CPU time per Cycle: 1 CPU minute per minute of battle for two versus four engagement (1 MIP machine).

Data Output Analysis: Approximately one day.

Frequency of Use: Used daily.

Users: McDonnell Douglas, USAF OT&E Center, ASD, AFWAL, and DARPA.

Comments: N/A.

TITLE: LDM - Logistics Decision Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Logistics Evaluation Agency, ATTN: LOEA-PL, New Cumberland Army Depot, New Cumberland, PA 17070-5007.

POINT OF CONTACT: Dr. L. P. D'Amato, (717) 770-7995, AV 977-7995.

PURPOSE: The LDM supports the U.S. Army's logistics planning, programming, and budgeting efforts by measuring the effect of Army logistics resource decisions in terms of combat outcomes.

DESCRIPTION:

Domain: Land.

Span: Theater.

Environment: Nonspecific.

Force Composition: Combined land forces.

Scope of Conflict: Conventional.

Mission Area: Theater land combat and logistics mission areas, including transportation, receipt and issuance of supplies (POL, AMMO etc.), and maintenance of equipment.

Level of Detail of Processes and Entities: Models combat at the theater level and individual logistics functional areas at each theater echelon. Weapons categories include tanks, armored personnel carriers, and infantry. Logistics process include transportation, receipt and issuance of supplies (POL, AMMO etc.), and maintenance of equipment.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Combat is aggregated to the theater level. Logistics is aggregated to mission areas at each theater echelon. Data must be available from a larger, more detailed, combat simulation model, such as the Army's Force Evaluation Model or Concept Evaluation Model. LDM must be calibrated to the combat portion of a specific case study with logistics system descriptions and factors derived from standard Army sources, including Force Analysis Simulation of Theater Administrative and Logistics Support results for the study and the Army Force Planning Data and Assumptions.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Pre- and postprocessors are being developed to speed up data input and results analysis. These processors will also make LDM accessible to non-ADP expert users.

INPUT: Occurs in two stages. The first extensive effort involves calibrating LDM to a large combat simulation and developing the associated logistics structure. The second simpler stage involves modifications to logistics resources for each variation being analyzed.

OUTPUT: Presently computer files that can be imported into standard software, such as LOTUS and dBASE III+, for analysis. In the future, LDB will also output reports and graphics containing aggregated data.

HARDWARE AND SOFTWARE:

Computer:	IBM AT compatible with math coprocessor.
Storage:	2 megabytes.
Peripherals:	Printer.
Language:	FORTRAN, LOTUS, and dBASE III+.
Documentation:	Under development.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: January 1989 (Scheduled).

Data Base: 1 to 4 months.

CPU Time per Cycle: 10 to 30 minutes.

Data Output Analysis: From several minutes to several weeks.

Frequency of Use: Extensive during resource decision processes.

Users: HQ Department of the Army, Office of the Deputy Chief of Staff for Logistics, and the U.S. Army Logistics Evaluation Agency.

Comments: LDM is a reproduction model that emulates the combat portion of larger, more detailed combat simulation models. As such, LDM must be calibrated to the combat portion of a specific case study. Logistics system descriptions and factors must be available from the base study or derivable from other sources. LDM represents logistics decrements or increments as changes in the capability of units or the availability of resources. Comparisons of outputs, such as forward line of own troops movement, RED and BLUE personnel losses, and equipment and supplies lost and remaining, give an indication of the effects on logistics resources, capacities, or capabilities.

TITLE: LFMD/AMIP - Logistics Functional Model Development for Army Model Improvement Program

MODEL TYPE: Analysis.

PROPONENT: U.S. Army TRAC-LEE, ATTN: ATRC-LF, Ft. Lee, VA 23801-6140.

POINT OF CONTACT: Mr. Billy Williams, (804) 734-5640-3449, AV 687-5640/3449.

PURPOSE: LFMD/AMIP will be used primarily as a combat development tool to examine new doctrine and competing strategies. It will provide the Army with a capability to (1) assess the impacts of combat on logistics and logistics on combat; (2) perform better force design trade-off analyses while assessing supportability and sustainability risks; (3) provide more credible and auditable planning factors; (4) better assess the benefits and costs of alternative reliability and maintainability hardware specifications; and (5) better compare and evaluate proposed logistics doctrine, organization, and materiel.

DESCRIPTION:

Domain: Land and air.

Span: Corps/Division.

Environment: Will model day and night operations; weather conditions; and terrain including rivers, mountains, roads, and cities.

Force Composition: Will model a mixture of air and land forces in accordance with AirLand battle doctrine.

Scope of Conflict: Conventional, chemical, rear-area.

Mission Area: All conventional combat and combat support missions except unconventional warfare.

Level of Detail of Processes and Entities: Lowest entity to be modeled is a unit, typically a maneuver unit of battalion size. Weapon systems are to be modeled as part of the unit entity. Processes include attrition of air and land forces based on Lanchester equations, consumption of commodities (fuel, ammunition, subsistence), resupply of commoditities (including emergency air resupply), and maintenance/medical functions.

CONSTRUCTION:

Human Participation: Not required--interruptable and scheduled changes.

Time Processing: Dynamic, event-step, but uses time steps for scheduling some actions.

Treatment of Randomness: Basically deterministic; outcome of combat is determined via Lanchester equations.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Model in planning stage and currently on hold.

INPUT: Forces and supply inventories, basic weapons performance data, other system performance data, geographic and terrain data, and tactical decision data.

OUTPUT: Casualties and systems losses, FLOT traces and force positions over time, and availability and condition of forces and supplies. These outputs will be principally graphic in nature. Logistics and maintenance transaction files that can be input to a user-developed postprocessor.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780, SUN 4/280.
Storage:	40 MB RAM, 500 MB mass storage.
Peripherals:	CRT, high-speed printer, and high-resolution color printer.
Language:	SIMSCRIPT II.5.
Documentation:	None (model under development).

SECURITY CLASSIFICATION: Model is unclassified, but input and output are expected to be classified.

GENERAL DATA:

Date Implemented: TBD.

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: As needed.

Users: TRAC-LEE and U.S. Army Logistics Center.

Comments: Since the model is only in the planning stage, the above information comes from the preferred requirements and may change by the time the model is in production (it is estimated that model development will come off of hold in 1992).

TITLE: LOCNES - Lock-on Range Calculation Needed in Electro-Optical Simulation

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. William McQuay, (513) 255-2164.

PURPOSE: LOCNES is a research and evaluation tool that determines the IR lockon ranges of IR seekers targeted against aircraft or cruise missiles with known IR signatures. It was developed to provide input to the AADEM model and models simulating one-on-one combat engagement between IR-homing missiles and aircraft or cruise missiles.

DESCRIPTION:

Domain: Land and air.

Span: Local and individual.

Environment: Many weather conditions.

Force Composition: One-on-one engagements.

Scope of Conflict: Conventional warfare (IR seekers).

Mission Area: Conventional missions involving IR-seeker interplay.

Level of Detail of Processes and Entities: Can be used to determine the IR lockon ranges either at different aspect angles relative to a target aircraft or relative to a fixed SAM site for different offsets of the approaching target aircraft. The LOWTRAN5 model, which serves as a subroutine, is used for the atmospheric transmittance calculations, which are required to solve the IR lockon range equation. The LOWTRAN5 model can be used to determine the transmittance with a resolution of about 20 cm-1 over the spectral region from 0.25 to 28.5 microns. It includes the effects of molecular and aerosol absorption and scattering.

CONSTRUCTION:

Human Participation: Not required. Model not interruptable.

Time Processing: Dynamic, closed form.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: The transmittance values obtained are based on a spectral resolution of 20 cm-1. Although the LOCNES program interpolates between the 5 cm-1 values contained in LOWTRAN5, these values still represent 20 cm-1 resolution. In addition, the aerosol models represent a simplified version of typical conditions. The scattering is single scattering only.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Target spectral radiant intensity or the band average radiant intensity with various options for wavelength dependence of the intensity; choice of peak-normalized relative response functions.

OUTPUT: Either IR lockon ranges displayed at various elevation and azimuthal angles or IR lockon ranges displayed at various offsets of a target aircraft relative to a fixed SAM site. In addition, quantitative validation of the scaling law for IR lockon ranges may be provided.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	249,344 bytes.
Peripherals:	None.
Language:	FORTRAN 77.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: March 1981.

Data Base: N/A.

CPU time per Cycle: Typically 400 seconds (approximately 2 sec/lockon range calculation).

Data Output Analysis: Manual analysis of tabular results.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: LOEM - Launcher Orders Evaluation Model

MODEL TYPE: Analysis.

PROPONENT: Vitro Corporation, 14000 Georgia Ave., Silver Spring, MD 20906.

POINT OF CONTACT: A. J. Ondrish, (301) 231-2097.

PURPOSE: LOEM is used to evaluate the capabilities of conventional STANDARD Missile (SM) launchers for a naval AAW weapon system.

DESCRIPTION:

Domain: Air.

Span: Worldwide.

Environment: Naval, at sea.

Force Composition: One ship.

Scope of Conflict: Conventional.

Mission Area: AAW.

Level of Detail of Processes and Entities: This model evaluates all aspects of a launcher's capability. The target and search radar model assumes a point target moving in 3-dimensional space. The inputs to the target model define initial target position at time-zero. Target speed, course, and climb and dive angles are represented by tabular functions of time with linear interpolation between tabulated points. Thus any flight path can be represented. The simulated radar is reasonably assumed to scan the target. Scan time variations of real targets are usually small and are time-tagged and rate compensated within the radar. Measured range, bearing, and evaluation are represented in the simulation as true values corrupted by the addition of Gaussian distributed random errors. The model ends at first missile movement; it prepares for engagement but does not simulate the firing of the missile.

CONSTRUCTION:

Human Participation: Not required after setup.

Time Processing: Dynamic.

Treatment of Randomness: Deterministic, but the radar model includes stochastic processes for acquisition of target.

Sidedness: Two-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Initial target position and other basic parameters.

OUTPUT: Dynamic simulation printout.

HARDWARE AND SOFTWARE:
Computer: IBM.
Storage: N/A.
Peripherals: Printer.
Language: CSMP and FORTRAN.
Documentation: Notes.

SECURITY CLASSIFICATION: N/A.

GENERAL DATA:
Date Implemented: N/A.

Data Base: Resident in model.

CPU time per Cycle: Less than one minute.

Data Output Analysis: Hard copies available for analysis.

Frequency of Use: Occasionally.

Users: Vitro uses LOEM in support of NAVSEA (TARTAR Program).

Comments: This simulation model has been used in the past five years to evaluate improvements to the SM Weapon Direction System.

TITLE: LOGATAK III - Logistics System Attack III

MODEL TYPE: Analysis.

PROPONENT: Defense Nuclear Agency, Theater Forces Division, Kirtland Air Force Base, NM 87117-5000.

The BDM Corporation, 7915 Jones Branch Drive, McLean, VA 22102.

POINT OF CONTACT: Edmund J. Bitinas (BDM), (703) 848-5246.

PURPOSE: LOGATAK III is a research and evaluation tool that can be used to support weapon systems effectiveness and force capability and requirements in order to assess courses of action, mix of systems, effectiveness, and resource planning and combat development for current or new doctrine and competing strategies in the broad areas of forces sustainability, mobilization and interdiction survivability, and effectiveness of ground forces and their supporting systems (airlift, sealift, ground transport, etc.).

DESCRIPTION:

Domain: A transportation network representing sea, air, or ground transportation links and nodes.

Span: Data-driven, from global to local (division).

Environment: Data-driven, includes time of day and trafficability.

Force Composition: Individual vehicles in convoy packages. Airlift, sealift, and heliborne can also be included.

Scope of Conflict: Rear-area. Weapons represented by the effect of using them, including persistent effects such as radiation and chemical contamination.

Mission Area: Sustainability, mobilization, and interdiction.

Level of Detail of Processes and Entities: Vehicles as individuals grouped into convoys (up to 99 types of vehicles), items of supply specific or by tonnage (up to 9999 types), specific supply bases, and specific targets. Attrition/damage is input by weapon type, and delay is input as time to repair/reconstitute once assets to perform the repair are made available.

CONSTRUCTION:

Human Participation: Not required. Model interruptable with scheduled changes.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Deterministic. Random values are generated from input distributions.

Sidedness: One-sided.

LIMITATIONS: Consumption of supplies, attacks, and loss of territory must be pre-scripted.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Additional enhancements to railroad movement logic for peacetime background traffic.

INPUT: Transportation network (road and rail are available for all of Europe, Korea, and Iran, while only railroad data bases are available for the Soviet Union), scenario, asset stockpiles, asset consumption rates, logistics vehicle capabilities and force size, time of movement source and destination.

OUTPUT: Printed listing of resource and network utilization, supply availability, and force arrival rates. Postprocessor graphics for dynamic measures.

HARDWARE AND SOFTWARE:

Computer:	Any VAX/VMS or IBM PS/2 version available.
Storage:	1 MB.
Peripherals:	Printer and hard copy graphics.
Language:	FORTRAN with DISSPLA graphics.
Documentation:	User's manual and internal code documentation.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: July 1984.

Data Base: One to three man-months.

CPU time per Cycle: Depends on scenario and scale; typically one to eight hours for entire run.

Data Output Analysis: Postprocessor provides graphics as well as raw data output.

Frequency of Use: One to three studies per year.

Users: U.S. Army Logistics Center and The BDM Corporation.

Comments: None.

TITLE: LOGNET - Logistics Data Network

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Logistics Evaluation Agency, Logistic Plans and Analysis Division (LOEA-PL), New Cumberland, PA 17070-5007.

POINT OF CONTACT: Mr. Michael G. Rybacki, (717) 770-6654, AV 977-6654.

PURPOSE: LOGNET is used primarily to assess materiel requirements and shortfalls of theater-level operation plans. It determines the EOH status of units in a force list and calculates an equipment redistribution plan to improve EOH status. LOGNET also calculates sustaining requirements and shortfalls for the force over time.

DESCRIPTION:
Domain: N/A.

Span: Theater-level aggregation for sustainment.

Environment: N/A.

Force Composition: Army units.

Scope of Conflict: Conventional warfare.

Mission Area: Materiel course-of-action assessment driven by major end item equipment densities.

Level of Detail of Processes and Entities: EOH status and redistribution are determined on a unit basis. Sustainment is computed in five-day increments beginning at d+000. Requirements and shortages are recorded by line item number and NSN for major end items, by standard study number and DoD Ammunition Code for ammunition, and by NSN for secondary items and bulk petroleum.

CONSTRUCTION:
Human Participation: Required for selection of parameters and processes.

Time Processing: Dynamic, time-step in five-day increments.

Treatment of Randomness: Deterministic using expected rates.

Sidedness: One-sided.

LIMITATIONS: Interim system is limited to assessment of major end items of equipment, conventional ammunition, bulk petroleum, and secondary items (identified as critical spare and repair parts in support of major end items on critical items lists).

PLANNED IMPROVEMENTS AND MODIFICATIONS: Full operational capability, which will include all classes of supply, is planned as an integral function within the Army WWMCCS Information System.

INPUT: Time-Phased Force Deployment List, materiel replacement and consumption rates, and Total Army Equipment Distribution Plan.

OUTPUT: Printouts and screen displays of time-phased materiel requirements and shortages. Redistribution plan is available on magnetic tape.

HARDWARE AND SOFTWARE:

Computer:	VAX computer with VMS operating system. Note that LOGNET functions in a dedicated machine environment.
Storage:	N/A.
Peripherals:	N/A.
Language:	Pascal, COBOL, VAX-11 Macro ASSEMBLY, and Ada.
Documentation:	In accordance with DoD Instruction 7935.1.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: July 1987 (Interim System).

Data Base: Three to seven days after receipt of data files.

CPU Time per Cycle: Depends on size of force list and selection of critical items lists.

Data Output Analysis: Hard copies of output reports. Limited capability for ad hoc query and tailored reports.

Frequency of Use: Varies by site.

Users: HQDA ODCSLOG, HQ FORSCOM, HQ USAMC, USALEA, and USAMC-LPSA (host site).

Comments: System operates on a dedicated secure computer network.

TITLE: Low Intensity Conflict Gaming System

MODEL TYPE: Education and training (can be used for analysis as well).

PROPONENT: War Gaming and Simulation Center, National Defense University, Fort Leslie J. McNair, Washington, DC 20319-6000.

POINT OF CONTACT: Mr. Bill Bedenbaugh, (202) 475-1251, AV 335-1251.

PURPOSE: The Low Intensity Conflict Gaming System provides a research tool for policy analysis and an educational tool to expose students, through war game seminars, to the nuances of dealing with the political, military, economic, social, and psychological aspects of political stability problems in Third World countries. The model examines these aspects in the context of an insurgency/counterinsurgency situation in a Latin American country, but the system's generic design can be modified for application to any country.

DESCRIPTION:

Domain: Abstract; the model simulates a country's internal economics, political and military effects of actions, changes in the social and political state of the general populace, and changes in internal politics in any intervening powers.

Span: Regional.

Environment: Elements such as terrain relief and weather are not specifically modeled.

Force Composition: The model portrays social, political, and economic population groups indigenous to the modeled region, as well as highly aggregated indigenous/allied military forces.

Scope of Conflict: The military forces modeled have conventional and unconventional warfare assets. Other entities, such as civilian and governmental, have social, political, and economic strength assets. All of these assets are represented as numerical levels of strength.

Mission Area: The primary mission of modeled entities (and the players) is the achievement of goals through the allocation of assets.

Level of Detail of Processes and Entities: The entities and processes modeled range in level from international to subnational groups and individuals.

CONSTRUCTION:

Human Participation: Required for decisions and processes. Players evaluate objectives and available assets, commit their resources, and report their decisions to the adjudicator who codes their actions for system input then decodes the results for the next turn of play.

Time Processing: Dynamic. Processes are time-stepped, as well as event-stepped when the model is used in an interactive gaming mode.

Treatment of Randomness: The model is normally operated in a direct computation mode.

Sidedness: Three or more sides can be represented, and each side can be reactive or nonreactive.

LIMITATIONS: Adjudicators for the game should be country experts and at least one must have experience in the use of the automated adjudication tool.

PLANNED IMPROVEMENT: Additional modules to simulate issues of terrorism, antidrug operations, peace keeping operations, and peacetime contingency operations are being considered.

INPUT: Input during play consists of numerically represented allocation of player assets.

OUTPUT: Consists of numerical changes in data values that represent player assets and the sociopolitical-economic situation of the modeled region.

HARDWARE AND SOFTWARE:

Computer:	Apple Macintosh II or SE, or IBM AT compatible computer.
Storage:	At least 1 MB RAM.
Peripherals:	Printers compatible with the computers listed above can be used, but are not required.
Language:	The software consists of a Microsoft Excel commercial spreadsheet application.
Documentation:	Design handbook, player handbook, data handbook, and sources book.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: July 1988.

Data Base: Requires approximately two months to develop.

CPU Time per Cycle: Minimal.

Data Output Analysis: Knowledgeable adjudicators can turn player actions into numerical inputs to model, run the model, and translate the output into text in three to six hours.

Frequency of Use: Intended for use in seminars at the National Defense University.

Users: National Defense University War Gaming and Simulations Center.

Comments: None.

TITLE: LOWTRAN 7

MODEL TYPE: Analysis.

PROPONENT: Geophysics Laboratory, Atmospheric Effects Branch, Hanscom AFB, MA 01731-5000.

POINT OF CONTACT: Maj Greg J. Donovan, 697-5793.

Model available from: National Climate Center, NOAA, Environmental Data Services, Federal Building, Asheville, NC 28801, (703) 259-0682, Ms. Yoland Goodge.

PURPOSE: LOWTRAN 7 calculates atmospheric transmittance and radiance, solar and lunar radiance, direct solar irradiance, and multiple scattered solar and thermal radiance averaged over 20 1/cm intervals.

DESCRIPTION:

Domain: Air.

Span: Global.

Environment: Profiles for 13 minor and trace atmospheric gases.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Individual band models for H20, 03, N20, CH4, CO, 02, CO2, NO, NO2, NH2, NH3, and SO2.

CONSTRUCTION:

Human Participation: Required for some parameter inputs.

Time Processing: Static.

Treatment of Randomness: Deterministic based on user inputs.

Sidedness: One-sided.

LIMITATIONS: Not all atmospheric gases are considered.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Unknown.

INPUT: User choice of gas, path length, and wavelength.

OUTPUT: Computer printouts, plots, and raw data.

HARDWARE AND SOFTWARE:

Computer: Available in several versions, compatible with most mainframe computers. ONTAR Corporation, 129 University Road, Brookline, MA 02146, produces PC version validated by Geophysics Lab for IBM PC/XT/AT, 80386, or compatible computer.

Storage: N/A.

Peripherals: N/A.

Language: N/A.

Documentation: N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: February 1989.

Data Base: N/A.

CPU time per Cycle: Unknown.

Data Output Analysis: N/A.

Frequency of Use: Sporadic; based on study demand.

Users: Numerous government agencies, research groups, and laboratories.

Comments: N/A.

TITLE: LRSAMP - Long Range Strategic Appraisal and Military Planning System

MODEL TYPE: Analysis.

PROPONENT: Strategic Plans and Policy Directorate (J-5), The Joint Staff, The Pentagon, Rm 2E949, Washington, DC 20318-8000.

POINT OF CONTACT: Dr. Jeffery Milstein, (202) 695-0025.

PURPOSE: LRSAMP is used primarily to analyze, forecast, plan, and provide decision support capabilities for satisfying long-range (out to 20 years) goals. These analyses help produce JSPS documents and aid the strategic planner in choosing appropriate strategies to meet U.S. national strategic goals.

DESCRIPTION:

Domain: Strategic assessments and military planning.

Span: Global and regional.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: Plans and policy.

Level of Detail of Processes and Entities: Countries and regions.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-step and event-step. Progresses through events at a user-specified ration of exercise time.

Treatment of Randomness: Deterministically based on planning concepts and rules.

Sidedness: N/A.

LIMITATIONS: Bounded domain of proposed strategic plans and programs.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Prototype under development.

INPUT: A user-created event (question), one strategic goal, and one region of the world.

OUTPUT: Graphics-based output charts and diagrams of military strategies and impacts of military strategies on specific goals.

HARDWARE AND SOFTWARE:

Computer: Designed to run on a SUN microcomputer with UNIX operating system.

Storage: N/A.
Peripherals: One printer and one color monitor.
Language: "C" and FORTRAN.
Documentation: Preliminary user requirements, system data flow diagrams, system analytical tools report.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Large historical data bases as well as current data CPU time per cycle.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: N/A.

Users: J-5 Strategy Division.

Comments: LRSAMP will be built on existing components of the Future Options Research Execution for the Computer Analysis of Scenario Tracing and Simulation (FORECASTS) system. This task is establishing a plan for the development of an LRSAMP system by determining system requirements through prototyping. The prototype system is being developed through the use of an expert system shell, NEXPERT Object. Additional statistical and decision analysis tools are being investigated to meet J-5 Strategy Division requirements.

TITLE: MABS-EX - Mixed Air Battle Simulator - Extended

MODEL TYPE: Analysis.

PROPONENT: USCINCPAC Staff (J55), Box 15, Camp H. M. Smith, HI 96961-5025.

POINT OF CONTACT: Mr. Ronald H. Uyehara, (808) 477-6467, AV (315) 477-6467.

PURPOSE: MABS-EX examines the effectiveness of an integrated air defense to evaluate force capabilities and develop force requirements. MABS-EX is used to study factors that influence the effectiveness of air defense systems. The model permits varying the numbers, locations, and characteristics of radars, SAM sites, AA guns, short-range SAMs, interceptors, bombers, ordnance, and noise-jamming equipment. The effectiveness of an air defense system is judged based on its ability to inflict damage on the enemy and prevent damage to itself.

DESCRIPTION:

Domain: Air. MABS-EX models the airspace needed to simulate an air attack on an air defense system. The geographical area that can be treated is limited only by the extent to which the earth's surface can be approximated by a rectangular coordinate system.

Span: Local and regional. Larger simulations are limited by the number of entities that can be represented. Position errors caused by projecting entities from a spherical surface onto a planar surface also limit MABS-EX applications above the regional level.

Environment: A smooth earth's surface is assumed with limited capabilities to model radar masking. Angle-to-mask, range-to-mask, and masking sector are the only radar masking parameters.

Force Composition: Large air attacks directed against an air defense network.

Scope of Conflict: Conventional.

Mission Area: Air defense.

Level of Detail of Processes and Entities: Individual aircraft or multiple-aircraft tracks. Individual radars and SAM sites. Attrition is bilateral.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric (one side nonreactive).

LIMITATIONS: Numbers and types of aircraft and SAM sites are limited; ECM is not modeled; flat earth is assumed for navigation.

PLANNED IMPROVEMENTS/MODIFICATIONS: None currently.

INPUT: Numbers of radars, SAM sites, interceptors, bombers, and tankers of each type; effective ranges and pKs for weapons such as SAMs, AA guns, and air-to-air missiles; radar ranges or a listing of "detect/leave" events generated outside the model (see description of MPRES model); terrain masking (range to and height of nearest obstacle); speeds and ranges of bombers; speeds and fuel consumption rates of interceptors; bomb damage potential (number of bombs, type of target, and expected CEP); IFF characteristics (probability of correct identification and probability of misidentification); and fire control delays and failure factors.

OUTPUT: Damage to each type of aircraft (number killed or damaged by each ground-to-air and air-to-air weapon system); damage to ground targets (fraction of each ground target surviving); summary of damage by each SAM system type; numbers and types of bombers surviving and used in each computer-generated attack wave; numbers of interceptors on the ground, assigned, in maintenance, attacking, and returning to base versus time for all attack waves.

HARDWARE AND SOFTWARE:

Computer:	Wang VS80B (OS 6.4); currently being rehosted to SUN 3/260 system.
Storage:	10 MB.
Peripherals:	Interactive terminal, printer.
Language:	FORTRAN IV.
Documentation:	User manual available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: Unknown.

Data Base: 2 to 3 man-months.

CPU Time per Cycle: 2 to 60 minutes.

Data Output Analysis: Variable.

Frequency of Use: As needed.

Users: USCINCPAC; U.S. Forces Japan; Combined Forces Command, Korea; Japan Self Defense Forces.

Comments: An attempt to rehost this model to the VAX 8650 was unsuccessful because the bit-packing scheme of the MABS-EX is incompatible with the VAX's representation of integers. See the Planned Modifications section above.

TITLE: MACATAK - Maintenance Capabilities Attack Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army TRAC-LEE, ATTN: ATRC-LF, Ft. Lee, VA 23801-6140.

POINT OF CONTACT: Bruce Lasswell, (804) 734-1050/3449, AV 687-1050/3449.

PURPOSE: MACATAK is an operations support tool that measures the survivability and vulnerability of division-level maintenance elements in conventional, chemical, and nuclear environments. The model assesses the effectiveness of the maintenance system as it experiences attacks both on the end items it supports and on the system itself.

DESCRIPTION:

Domain: Land.

Span: Variable.

Environment: N/A.

Force Composition: Primarily division-level maintenance elements.

Scope of Conflict: Conventional, chemical, and nuclear.

Mission Area: Maintenance system.

Level of Detail of Processes and Entities: The maintenance system and the end items it supports can suffer attrition. End item types come into the system due to combat damage and RAM. End items wait in queues for parts, skills, and equipment, and the waiting time is used in the computation of maintenance turnaround time (TAT). Maintenance TAT is assessed for each end item type as a function of waiting time and repair time.

CONSTRUCTION:

Human Participation: Not required--scheduled changes.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Number and type of equipment in each using unit; number and MOS of maintenance personnel; inventory of DX components at each maintenance activity; equipment usage rates and failure rates; maintenance action information such as time to repair, frequency of occurrence, and contact team; time it takes for parts to arrive; and scenario.

OUTPUT: Tabular printouts of probable equipment availability; tabular listing of equipment maintenance TAT; tabular listing of TAT broken into function segments; and tabular printouts of queue sizes for parts, skills, and equipment as a function of time. A binary transaction file is created for additional postprocessing.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	Variable.
Peripherals:	Printer and tape drive.
Language:	FORTRAN IV, GASP IV, and FORTRAN 77.
Documentation:	Maintenance Support Study for INFS. March 1980; Users' Manual for MACATAK, March 1980; and Programmers' Guide for MACATAK, March 1980.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
1979.

Data Base: N/A.

CPU time per Cycle: Varies.

Data Output Analysis: One to four weeks.

Frequency of Use: As needed.

Users: Proponent, U.S. Army Ordnance Missile and Munitions School, U.S. Army Logistics Center, and BDM Corporation.

Comments: MACATAK was created using the Models of the Army Worldwide Logistics System (MAWLOGS).

TITLE: MACRO

MODEL TYPE: Analysis.

PROPONENT: Vector Research, Incorporated, P.O. Box 1506, Ann Arbor, Michigan 48106.

POINT OF CONTACT: George Miller, (313) 973-9210.

PURPOSE: MACRO is a research and evaluation tool dealing with force capability and requirements. It is useful for providing a setting for corps-level studies, performing large-scale force structure analyses, filtering alternative strategies prior to a detailed study, and making quick tradeoff estimates.

DESCRIPTION:

Domain: Land and air.

Span: Theater.

Environment: The diurnal cycle is the only environmental status explicitly represented.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional warfare.

Mission Area: Conventional land warfare with associated air support.

Level of Detail of Processes and Entities: MACRO is a highly aggregated model whose corps-level structure and results are based on fits to the results of a more detailed corps-level model. Forces are divided into fixed-wing aircraft, attack helicopters, artillery, short-range antitank weapons, and ground maneuver forces. Representation of these forces requires the user to translate details of military forces and operations into the abstract form required by the mathematical models embedded in the simulation. Forces are affected by arrival, commitment to corps areas from the theater rear, movement within corps areas, attrition, retirement from corps areas, reconstitution, and repair.

CONSTRUCTION:

Human Participation: Not required. Scheduled changes are allowed.

Time Processing: MACRO is a dynamic model that consists of a set of linked differential equations describing the trajectory of campaign results over time. The equations are solved by Runge-Kutta techniques.

Treatment of Randomness: Deterministic, employs differential equations to approximate expected campaign results over time.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Because MACRO is fitted to the results of a more detailed model, it cannot be used to examine forces that contain weapons not played in the

runs to which it was fit, use tactics that were not considered, or involve extreme variations in force ratios or force structures. Because the model is deliberately abstract, users must translate the details of military forces and operations into the abstractions of a mathematical model.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The SHAPE Technical Centre periodically updates the fit of MACRO as new detailed model results become available.

INPUT: Initial values of the state vector; theater-level data, much of which is used by the algorithms governing commitment of forces; corps-level performance data, including data describing the fit to the more detailed corps-level campaign model; and data describing force arrivals.

OUTPUT: A periodic situation display in each corps, describing allocations, strengths, and attrition of forces by type, maximum penetration, and rate of FLOT movement. A periodic display of the state vector in each corps. A periodic summary of air operations and losses in each corps and of the status of replacement pools and repair queues in each corps. The frequency of output is controlled by the user.

HARDWARE AND SOFTWARE:

Computer:	MACRO runs on CDC, IBM, and Andahl mainframe and Concurrent and DEC minicomputers under a variety of operating systems.
Storage:	Between .4 and 1.2 MB.
Peripherals:	No special peripherals are required.
Language:	Transportable FORTRAN.
Documentation:	Users manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1983.

Data Base: One or two person-days to develop data for application of the model with an existing fit. Significantly more time to refit to new detailed model results.

CPU time per Cycle: Execution time for a 30-day war varies between five minutes and one hour depending on the computer used.

Data Output Analysis: A few minutes to a few hours are required to analyze the output for a 30-day war.

Frequency of Use: Several studies per year.

Users: SHAPE Technical Centre, Defense Operational Analysis Establishment, British Aerospace, and Vector Research, Incorporated.

Comments: Original fit of the corps-level model was based on results of SHAPE Technical Centre's Armour/Anti-Armour Study. These results were produced for the various corps areas of the NATO Central Region using the highly detailed VECTOR-2 campaign model.

TITLE: MACRO-2 - Model of Aggregated Central Region Operations

MODEL TYPE: Analysis.

PROPONENT: SHAPE Technical Centre, P.O. Box 174, 2501 CD The Hague, The Netherlands.

POINT OF CONTACT: T.K. Jensen, xx-31-70-142303, IVSN 257-2303 and T. Langsaeter, xx-31-70-142303, IVSN 257-2302.

PURPOSE: MACRO-2 is used for dynamic analysis of arms control options for preliminary quick assessments of force capabilities under different assumptions of force reductions.

DESCRIPTION:

Domain: Land and air.

Span: Regional.

Environment: N/A.

Force Composition: Combined and joint, RED and BLUE.

Scope of Conflict: Conventional land combat in the NATO Central Region (a Southern Region version has recently been developed).

Mission Area: Conventional missions.

Level of Detail of Processes and Entities: Structurally, the model is a set of difference equations describing changes in force strengths in various corps areas, FEBA positions and velocities, cumulative commitments, losses, etc. The forces in MACRO-2 are divided into OAS-aircraft, helicopters, artillery, and ground forces not otherwise broken out. Forces may be at two distinct depths within a corps area or may be behind the corps areas. Forces are affected by six processes including arrival, commitment to corps areas from region, forward and rearward movement in corps areas, attrition, retirement from corps areas, reconstruction of retired forces, and repair of kills. Deployment of forces from regions and allocation of air support is automated according to a "preselected concentration points" versus "cohesive defense" philosophy.

CONSTRUCTION:

Human Participation: Not permitted (close loop simulation).

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: MACRO-2 has to be calibrated to the results from more detailed models (IDAHEX), thus new calibration is necessary when different force structures and different tactics are introduced. Representation of air-ground combat is rudimentary, and air-air combat is not modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Graphical output.

INPUT: Scen data such as in-place forces, reinforcements, availability times, main of attacks, etc., and corps-level performance data such as attrition coefficients, terrain and defense preparation, characterization, reconstitution times, etc.

OUTPUT: Computer printout with a tabular summary of the situation printed at user-selected intervals (typically once daily).

HARDWARE AND SOFTWARE:

Computer:	CYBER 840 under NOS VE IBM PC AT, IBM PS2, or equivalent under MS-DOS.
Storage:	250K for the PC version.
Peripherals:	Printer (preferably with 14" paper).
Language:	FORTRAN V.
Documentation:	Under preparation.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Calibration can take 1 to 2 months, and the rest of the data base less than a week.

CPU time per Cycle: Less than 15 seconds on PS2 (6-hour cycles).

Data Output Analysis: One day or less.

Frequency of Use: Used continuously.

Users: SHAPE Technical Centre, Defence Operational Analysis Establishment, Industrieanlagen-Betriebsgesellshaft mbH Trier.

Comments: N/A.

TITLE: MARGI-SIOP - Strategic Air Command Methodology for Analyzing Reliability and Maintainability Goals and Investments

MODEL TYPE: Analysis.

PROPONENT: HQ AF/LE-RD, The Pentagon, Room 4E259, Washington, DC 20330-5130.

POINT OF CONTACT: Lt. Col. P. Aitken-Cade, HQ AF/LE-RD, (202) 697-2875, AV 227-2875; or Jim Kerr, ANSER Inc., (703) 685-3174.

PURPOSE: MARGI-SIOP is an evaluation tool that addresses the contribution of reliability and maintainability to the warfighting capability of nuclear bombers (e.g., B-1, B-52). It also serves as a valuable decision support system for prioritizing Class IV modifications.

DESCRIPTION:

Domain: Aircraft generation and in-flight to target.

Span: Global.

Environment: Enemy targets and enemy threat.

Force Composition: U.S. strategic forces.

Scope of Conflict: U.S. strategic nuclear.

Mission Area: Aircraft strategic nuclear missions.

Level of Detail of Processes and Entities: Aircraft subsystem level.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Event-step simulation for aircraft generation and sequential for in-flight calculation.

Treatment of Randomness: Stochastic, Monte Carlo for ground generation and deterministic expected value for in-flight calculation.

Sidedness: One-sided.

LIMITATIONS: One target only; recovery of aircraft not considered.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Extend to encompass Class V modifications.

INPUT: Aircraft subsystem reliability, repair time, and spares availability, and the number of work crews capable of repairing the subsystems. In-flight success probability by mission flight phases for subsystem failure states.

OUTPUT: Tabulation of damage expectancy degrade due to each subsystem. Graphs also generated for sensitivity analysis on subsystem reliability.

HARDWARE AND SOFTWARE.

Computer:	IBM PC compatible with 512K RAM and MS DOS operating system.
Storage:	Two double-sided, double-density disk drives; removable hard drive preferred.
Peripherals:	Color graphics adapter and color monitor. Useful but not required to have Epson FX graphics capable printer.
Language:	Turbo Prolog 1.1, Turbo Pascal 3.0, and Microsoft FORTRAN 77, Version 4.01.
Documentation:	User's guide.

SECURITY CLASSIFICATION: Unclassified, but working data base is classified secret.

GENERAL DATA:

Date Implemented: 1986.

Data Base: One week.

CPU time per Cycle: Minutes.

Data Output Analysis: Immediate.

Frequency of Use: Several times per year.

Users: HQ SAC/XRRM, HQ SAC/XRTL, and various others.

Comments: Provisions for an integrated cost module to determine the life-cycle cost of a modification. Cost module available from Synergy Corporation.

TITLE: MARGI-TAC - Methodology for Analyzing Reliability and Maintainability Goals and Investments for Tactical Air Forces

MODEL TYPE: Analysis.

PROPONENT: HQ AF/LE-RD, The Pentagon, Room 4E259, Washington, DC 20330-5130.

POINT OF CONTACT: Lt. Col. P. Aitken-Cade, HQ AF/LE-RD, (202) 697-2875, AV 227-2875, or Jim Kerr, ANSER Inc., (703) 685-3174.

PURPOSE: MARGI-TAC is an evaluation tool that addresses the contribution of reliability and maintainability to warfighting capability. It also serves as a valuable decision support system for prioritizing Class IV modifications.

DESCRIPTION:

Domain: Land and air.

Span: Single base in theater.

Environment: Enemy targets, enemy threat.

Force Composition: U.S. tactical forces.

Scope of Conflict: U.S. tactical conventional.

Mission Area: Aircraft tactical air-to-ground missions.

Level of Detail of Processes and Entities: Aircraft subsystem level.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, event-step simulation.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: One target per sortie.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Extend to encompass Class V modifications.

INPUT: Aircraft subsystem reliability, repair time, and number of spares, and the number of work crews capable of repairing the subsystems. In-flight success probability by mission flight phases for subsystem failure states. Includes Analytic Hierarchy-based model to determine probabilities.

OUTPUT: Produces screens or printouts of number of targets destroyed, sorties, attrition, battle damage, etc. Shows relations of measures of effectiveness to subsystem reliability and maintainability. Graphs also generated for sensitivity analysis on subsystem reliability.

HARDWARE AND SOFTWARE:

Computer:	IBM AT or 386 compatible with 512K RAM and MS DOS.
Storage:	Two double-sided, double-density disk drives. Removable hard disk drive desired.
Peripherals:	Useful but not required to have color graphics adapter, color monitor, and Epson FX graphics capable printer.
Language:	Turbo Prolog 1.1, Turbo Pascal 4.0, and Microsoft FORTRAN 77, Version 4.01.
Documentation:	User's guide and annotated software.

SECURITY CLASSIFICATION: Unclassified, but working data base is classified secret.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Initial data base one to four weeks.

CPU time per Cycle: Hours.

Data Output Analysis: Immediate.

Frequency of Use: Several times per year.

Users: HQ TAC/SMO R&M and various others.

Comments: Provisions for integrated war reserve spares kit and life cycle cost modules; available separately from Synergy Corp.

TITLE: Markov Survivability Model

MODEL TYPE: Analysis.

PROPONENT: CECOM AMSEL-PL-SA, Fort Monmouth, NJ 07703-5000.

POINT OF CONTACT: Mr. Edwin Goldberg, (201) 532-3646, AV 992-3646.

PURPOSE: The Markov Survivability Model is a research and evaluation tool that deals with combat development. It can assess the effects of design, operational, maintainability, and repairability options on the survivability of a system in a battlefield environment.

DESCRIPTION:
Domain: A combination of any of the above.

Span: Local.

Environment: Models the survivability of any system in a battlefield environment.

Force Composition: Component and element.

Scope of Conflict: Conventional.

Mission Area: Air, land, and sea weapons and systems.

Level of Detail of Processes and Entities: Systems component.

CONSTRUCTION:
Human Participation: Required for bounding the model and determining transition probabilities.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, direct computation.

Sidedness: One-sided.

LIMITATIONS: Depends on computational determination of transition probabilities. Analyzes one weapon system at a time.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Transition probabilities; determined by experiment or analysis.

OUTPUT: Statistically analyzed data.

HARDWARE AND SOFTWARE:
Computer: Any.
Storage: Minimum storage required.
Peripherals: Printer.

Language: Any.
Documentation: Proceedings, 26th Annual U.S. Army Operations Research Symposium, AORS XXVI, 13-15 October 1987, Fort Lee, VA, Volume III, pp. 35-49.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1980.

Data Base: Time needed to prepare data base depends on the situation; typical time might be 30 days.

CPU time per Cycle: Negligible.

Data Output Analysis: Computer output is self-instructive and complete.

Frequency of Use: N/A.

Users: CECOM, Fort Monmouth and DoD consultants.

Comments: N/A.

TITLE: MASS - Mobility Analysis Support System

MODEL TYPE: Analysis.

PROPONENT: CINCMAC Analysis Group, Headquarters, Military Airlift Command, Scott AFB, IL 62225-5001.

POINT OF CONTACT: Lt Col John C. Marcotte, Jr., (618) 256-8713, AV 576-8713.

PURPOSE: MASS models the interactions between strategic airlifters in the military airlift system. It can be used to evaluate resourcing or capabilities of a specified airlift force structure.

DESCRIPTION:

Domain: Air and airfields.

Span: Global.

Environment: Time and space correlated observations and forecasts. Seasonal enroute winds at 25,000 and 35,000 feet.

Force Composition: MAC Strategic Airlift Forces including KC-10 and Civil Reserve Air Fleet.

Scope of Conflict: Models mobility requirements of any level of conflict.

Mission Area: Airlift.

Level of Detail of Processes and Entities:
Processes: Models all phases of the ground handling of airlift aircraft. In-flight processes allow air refueling, diversion, and aerial delivery. Allows attrition through predetermined probability of kill.
Entities: Models performance, ground times, maintenance, and cargo capabilities of all strategic airlift aircraft (including Civil Reserve Air Fleet). Also models aircrews and their flying hour limits for military airlifters.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step model.

Treatment of Randomness: Most processes allow the user to select deterministic or Monte Carlo scheduling of completion and probability of occurrence.

Sidedness: One-sided.

LIMITATIONS: Does not model interaction with theater airlift or other mobility assets.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Interface with theater airlift.

INPUT: All characteristics of the entities, airfields, resources, and movement requirements.

OUTPUT: Large data files with information on aircraft and crew itineraries and resource usages.

HARDWARE AND SOFTWARE:

Computer:	Currently under development on Concurrent Computer Corp. 3260 minicomputer. Also ported to Honeywell DPS-90 mainframe.
Storage:	Depends on run length and detail desired.
Peripherals:	None.
Language:	FORTRAN 77.
Documentation:	Limited.

SECURITY CLASSIFICATION: Unclassified, but several data sources are classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Requires significant amount of staff contribution from within functional areas.

CPU time per Cycle: Up to several hours depending on length of scenario and amount of detail desired (I/O time).

Data Output Analysis: Relational data base management system desired.

Frequency of Use: Still under development.

Users: HQ MAC, USAF/Center for Studies and Analysis, OSD/PA&E (Mobility) are anticipated users.

Comments: Estimate completion in Dec 1988.

TITLE: MATADOR

MODEL TYPE: Analysis.

PROPONENT: System Assessment Group, Royal Military College of Science, Shrivenham, Swindon, Wiltshire SN6 8LA U.K.

POINT OF CONTACT: Dr. K. Wand, Swindon (0793) 785538

PURPOSE: MATADOR is a fast analytic model used to evaluate different tank options with the context of a stochastic duel between two weapon systems.

DESCRIPTION:

Domain: Land.

Span: One-versus-one duel.

Environment: N/A.

Force Composition: One tank on each side.

Scope of Conflict: Conventional.

Mission Area: N/A.

Level of Detail of Processes and Entities: Firing cycle of each combatant broken down into detection, firing, and kill probability.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, closed form.

Treatment of Randomness: Stochastic. Exact analytic formulation of the situation is modeled. Firing times may be constant or follow Erlang distributions.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Does not model mobility of tanks.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Possibility of including guided weapon systems.

INPUT: Detection times, probability of detecting firing signature, firing time for first and subsequent shots, kill probabilities, and number of shots fired before jockeys.

OUTPUT: Probability of win for each side, probability that no kill occurs.

HARDWARE AND SOFTWARE:

Computer: SIRIUS 1 Microcomputer, MSDOS.

Storage: 256 KB.

Peripherals: Compatible printer.
Language: MS-Pascal.
Documentation: User guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: N/A.

Data Base: N/A.

CPU time per Cycle: Negligible. Depending upon input data, CPU time is typically a few minutes.

Data Output Analysis: Negligible.

Frequency of Use: Intermittent.

Users: RMCS.

Comments: N/A.

TITLE: MAWLOGS - Models of the Army Worldwide Logistics System

MODEL TYPE: Analysis.

PROPONENT: U.S. Army TRAC-LEE, ATTN: ATRC-LF, Ft. Lee, VA 23801-6140.

POINT OF CONTACT: Bruce Lasswell, (804) 734-1050/3449, AV 687-1050/3449.

PURPOSE: MAWLOGS is an operations support tool. It is a computerized logistics modeling system that generates models to simulate the activities and measure the behavior of a particular logistics system structure with specific policy and procedure content at a level of detail chosen by the user. Its primary focus of concern is to simulate any of a wide range of alternative logistics system structures, policies, and procedures involving maintenance, supply, transportation, and communications (and their interactions), and to measure characteristics workloads, performance, and costs.

DESCRIPTION:

Domain: Land and air.

Span: Variable.

Environment: Variable.

Force Composition: Variable level logistics system.

Scope of Conflict: Conventional, chemical, and nuclear.

Mission Area: Logistics system.

Level of Detail of Processes and Entities: The keystone of the MAWLOGS system is the model assembler, which is a program that constructs a simulation model of a system represented as a network of functional nodes whose policy and procedural content are specified in terms of modules (i.e., blocks of computer program logic representing a logistics activity or policy). The level of aggregation may be varied widely, from great to little detail, from troop unit to wholesale activities. Simulated time is treated on an event-sequence basis. Except for a shortest chain algorithm in the route selection logic of transportation, no optimizing algorithms are in the present module library.

CONSTRUCTION:

Human Participation: N/A.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Either stochastic, Monte Carlo or basically deterministic as required by the user.

Sidedness: One-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Model assembler: description of system (model description) for which a model is to be generated including nodes, modules, and a module library (on tape). Model: policy parameter settings; resource levels; and demand characteristics such as capabilities, delay times, and constraints of system elements.

OUTPUT: A source code for model described in input model description.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780, UNISYS 1100 series.
Storage:	Variable.
Peripherals:	Printer and tape drive.
Language:	FORTRAN IV, GASP IV, and FORTRAN 77.
Documentation:	Users' and technical documentation.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1974.

Data Base: N/A.

CPU time per Cycle: Typically one hour.

Data Output Analysis: Three to six months.

Frequency of Use: As needed.

Users: Proponent and BDM Corporation.

Comments: N/A.

TITLE: MAWM - Modular Air War Model

MODEL TYPE: Analysis.

PROPONENT: McDonnell Douglas Corporation, McDonnell Aircraft Company, P.O. Box 516, St. Louis, MO 63166.

POINT OF CONTACT: Mr. Marv Goldner, (314) 777-5504.

PURPOSE: The MAWM emphasizes the impact of tactical aircraft on theater air and ground combat over periods of 10 days or more. Portions of the Tactical Warfare (TACWAR) model were incorporated into the MAWM, creating a more credible ground war and allowing key benefits of second echelon and interdiction attacks by aircraft to be addressed.

DESCRIPTION:

Domain: Air and land.

Span: Accommodates any theater depending on data base; only Central Europe has been completed.

Environment: Day and night operations, defensive positions, three terrain levels, and logistics supply network.

Force Composition: Combined forces, BLUE and RED.

Scope of Conflict: Primarily conventional warfare, but some limited chemical and biological effects possible.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: Different for air and ground. The smallest air element is one or more aircraft of a single type located at a single airbase. When airborne in a raid, one or more such elements can be temporarily combined and treated as a point. Aircraft performance including payload radius, repair, time-distance, and weapon system effectiveness are reflected in MAWM. Aircraft assets are allocated to offensive and defensive missions. Air combat is input as a function of mission, aircraft type, and force ratios. Aircraft sorties are suppressed through runway damage inflicted in airbase attacks. Detection and reaction to air raids, aircraft failures, aircraft and airbase repairs, reserves, and replenishment are simulated. Ground forces are more aggregated than air forces; divisions that have 10 weapon types are the typical size of a unit. Attrition from threat air and ground assets, amount of C3 available to the division, and the logistic supply network influence the ground division effectiveness. A grid comprised of sectors and subdivided into battle areas shows the basic location of divisions.

CONSTRUCTION:

Human Participation: Not required; scheduled changes possible.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Deterministic, generates value as a function of an expected value.

Sidedness: Two-sided, symmetric.

LIMITATIONS: A single supply type is modeled and C3 effects are very rudimentary. Deep air interdiction is not directly modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Enhanced graphics and development of alternative sources of air-to-air combat attrition.

INPUT: Air-to-air attrition tables, aircraft and weapon system performance and effectiveness tables, and ground and supply data.

OUTPUT: Several reports including summary, 6 air war reports, and 10 ground war reports. Reports taken at preset times and/or end of each day.

HARDWARE AND SOFTWARE:

Computer:	DEC VAX computer with a VMS operating system.
Storage:	10,000 blocks (5 MB).
Peripherals:	Minimum requirements: 1 terminal, 1 disk pack.
Language:	FORTRAN Extended.
Documentation:	Draft users guide plus computer documentation files for all input values and calling sequences.

SECURITY CLASSIFICATION: N/A.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Several man-months for a completely new data base. Adaptation of an existing one, (e.g., for a new aircraft type) would be less than one week.

CPU Time per Cycle: Approximately 5 minutes for 10 days of combat on a VAX 8800.

Data Output Analysis: Minimal graphics available, e.g., drawdown, sorties flown, and exchange ratios.

Frequency of Use: Varies, but has been used up to 30 runs per day in final study phase.

Users: MCAIR, DAC, and IDA.

Comments: Used on the Northrop MCAIR ATF program as well as other IRAD/CRAD studies at MCAIR.

TITLE: MBCS - Minefields and Barriers Combat Simulation

MODEL TYPE: Analysis.

PROPONENT: CA4 Branch, RARDE, Fort Halstead, Sevenoaks, England.

POINT OF CONTACT: N/A.

PURPOSE: The MBCS is used for weapons systems effectiveness studies at battlegroup level.

DESCRIPTION:

Domain: Land.

Span: Local.

Environment: 100-meter terrain grid holding heights and cultural data.

Force Composition: BLUE battlegroup vs. RED regiment.

Scope of Conflict: Conventional.

Mission Area: Contact battle.

Level of Detail of Processes and Entities:

Entity: Individual vehicles or GW teams.

Processes: Direct Fire - Different classes of weapons (e.g., CLOS, Fire and Forget, and Ripple Fire) represented with separate engagement sequences for each. Lethality is by pH, then M, F, MF or K kill criteria.

Artillery - Preplanned missions only. Missions may be smoke, RDMs, or lethal.

Minefields - Prelaid or RDMs. Individual mines are represented, and encounter geometry is handled in detail.

Movement - Along prespecified routes. Speeds governed by gradient, rolling resistance, vehicle, and engine details.

Acquisition - Uses NVEOL equations.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: No infantry, helicopters, or C3I.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Vehicle, weapon, and ammunition characteristics; ORBAT, deployment, routes and orders; minefield and barrier information; and probability data (mine and artillery lethality, pH, and pK data for direct fire systems).

OUTPUT: Many different categories of information, including killer/victim and firer/target tables for each instance of combat and the averages of those instances, shots and kills by range, and event trace.

HARDWARE AND SOFTWARE:

Computer:	VAX/VMS.
Storage:	Preprocessor 50,000 blocks; simulation 30,000 blocks.
Peripherals:	None specifically needed.
Language:	FORTRAN IV, reconditioned to FORTRAN 77.
Documentation:	Management summary, model definitions, user guide, programmer's guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Approximately six man-months.

CPU time per Cycle: Preprocessor 2 hours, intervisibility 50 hours, and simulation approximately 2 minutes of CPU time for 1 minute of battle.

Data Output Analysis: Minimal CPU time.

Frequency of Use: Rare.

Users: CA4 Division and RARDE. AMSAA (Aberdeen Proving Ground) has a version that differs in several respects, specifically in artillery.

Comments: For efficiency, all data including all intervisibility calculations is converted into direct access files by the preprocessor. The simulation acts only on these direct access files.

TITLE: MEM - Mission Effectiveness Model

MODEL TYPE: Analysis.

PROPONENT: HQ Space Division, CNCIS, Los Angeles AFB, P.O. Box 92960, Los Angeles, CA 90009-92960.

POINT OF CONTACT: Lt. Dale Brown, (213) 643-0036, AV 833-0036.

PURPOSE: The Mission Effectiveness Model (MEM) simulator is a ballistic missile defense architecture analysis tool. It models the major functions of a strategic defense system operating against a ballistic missile threat during a simulated end-to-end scenario. The model is designed specifically to help intersegment system design options. It can analyze the performance sensitivity of proposed architectures to their critical design parameters. It can also be used to help evaluate or derive functional system requirements.

DESCRIPTION:

Domain: Terrestrial, air, and space.

Span: Global.

Environment: Models air and space operations including atmospheric effects on missiles, space environment, and orbital/trajectory parameters.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Primarily nuclear ballistic missiles for the offensive forces and non-nuclear (directed energy, kinetic energy, and neutral particle beam) weapons for the defensive forces.

Mission Area: Ballistic missile defense and some aspects of space control.

Level of Detail of Processes and Entities: Models individual weapons (e.g., space-based interceptors, ballistic missiles, and ground-launched interceptors) throughout their flights and engagements. Models communications, battle management, satellite attrition, perceived and actual engagement results, and sensor performance.

CONSTRUCTION:

Human Participation: Not required after input/output file selection.

Time Processing: Dynamic, time- and event-step. Progresses through events at user-specified time increments.

Treatment of Randomness: Deterministic except ASAT engagement, which can be either deterministic or stochastic with Monte Carlo determination of results.

Sidedness: Models one-sided ballistic missile defense and ground-based ASAT operations.

LIMITATIONS: Currently no option to assess Monte Carlo weapon kill assessment for non-ASAT engagements.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Two-sided, symmetric, reactive ballistic missile defense and space control simulator with survivability enhancements (expected October 1988).

INPUT: DEFSYS module defines all elements of space and ground systems and simulation run parameters. THREAT module defines all elements of threat scenario and forces.

OUTPUT: Computer printouts, plot raw data postprocessors and graphical analysis.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780 or better, SUN family workstations, PC (Graphics).
Storage:	3500 lines of FORTRAN 77.
Peripherals:	None required; graphics terminal for data postprocessor graphics or line printer for report review.
Language:	FORTRAN 77.
Documentation:	User's Manual, Technical Reference Manual, and Validation & Verification Manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Preparation and population of large data bases can take several man-years.

CPU time per Cycle: Depends on data base size and player configuration; large simulations can take one hour of CPU time to process one hour of ballistic missile defense and ASAT operations.

Data Output Analysis: Postprocessor aids in analysis of output and produces graphical display and hard copies of new data.

Frequency of Use: Varies by organization, but is used at least monthly by those listed below.

Users: AF Space Division; The Joint Staff/J-8 NFAD; SDIO National Test Bed.

Comments: MEM is managed by the DoD MEM Configuration Control Office, USAF HQ Space Division/CNCIS. It is continually upgraded based on priorities established by the MEM Configuration Control Office.

TITLE: MEM - Multiple Engagement Module

MODEL TYPE: Analysis.

PROPONENT: Joint Strategic Target Planning Staff (JSTPS), Offutt AFB, Omaha, NE 68113.

POINT OF CONTACT: Joint Strategic Target Planning Staff (JLAA), LT Zumbar, USN, AV 271-3997.

PURPOSE: MEM is used to assess attrition of the ICBM/SLBM portion of the SIOP visible to Soviet ballistic missile defenses. MEM is a time-sequenced program that steps through the engagement in chronological order: entering vehicles, moving them along their trajectories, determining radar acquisitions, computing intercept conditions, launching interceptors, and processing the nuclear detonations that result. Measures of merit computed include the probability of penetration (PTP) by individual sortie basis by weapon systems and by targets. MEM also concerns itself with ABM fratricide avoidance, chaff and blackout, radar data processor overload, ABM defense doctrines, and nuclear effects.

DESCRIPTION: MEM is two-sided, stochastic model that deals with land and sea forces. It was designed to be executed for individual sorties; it can be manipulated for 6 radar types, 30 radars, 5 ABM types, 15 weapon types, and 10 booster types. MEM was primarily designed to operate on the individual sortie or weapon system level. It can range from 1000 exoatmospheric objects to 250 total targets. MEM is a time-step model that uses Runge-Kutta numerical integration and spherical rotating earth equations of motion.

Domain: Air and space.

Span: Global strategic nuclear warfare.

Environment: N/A.

Force Composition: Joint forces; BLUE and RED.

Scope of Conflict: Strategic nuclear.

Mission Area: Tactical warning and assessment.

Level of Detail of Processes and Entities: Models the individual reentry vehicle and defensive missile.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, one side nonreactive.

LIMITATIONS: The number of targets that can be attacked make it too small for SDI, and the long detailed run time would require a supercomputer if more targets were used.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Weapons data files, nuclear effects data files, defense data files, and offensive/target data files.

OUTPUT: Hard-copy reports of an attrition summary, launch summary, launch analyses, PTP summary, radar load plots, engagement history, battle summary, and common block contents.

HARDWARE AND SOFTWARE:

Computer:	Vax 8700, IBM 3033, UNIVAC 1100/61.
Storage:	N/A.
Peripherals:	VMS, MVS, ECL.
Language:	FORTRAN.
Documentation:	User's manual, December 1983.

SECURITY CLASSIFICATION: Top secret.

GENERAL DATA:

Date Implemented: November 1986.

Data Base: 1 month.

CPU time per Cycle: 3 hours.

Data Output Analysis: 2 weeks.

Frequency of Use: Once a year to start war game.

Users: JSTPS, OP-654, JCS (J-8), DIA.

Comments: Linked to System for Integrated Nuclear Battle Analysis Calculus (SINBAC) for use in the SIOP/RISOP war games.

TITLE: MICA - Multiple Launch Rocket System (MLRS) Interactive Computer Aid

MODEL TYPE: Training and education (also used for analysis of decision processes).

PROPONENT: Centre for Operational Research and Defence Analysis (CORDA), 233 High Holborn, London WC1V 7DJ, England.

POINT OF CONTACT: J. B. Taylor, CORDA, 44-1-831-6144.

PURPOSE: MICA is used primarily for individual skills development. It can also be used as an exercise driver for an individual or a command post.

DESCRIPTION:

Domain: Land.

Span: N/A.

Environment: Different "goings" can be specified by altering data controlling activity delays.

Force Composition: Nine launchers.

Scope of Conflict: Conventional warfare: typically three types of ammunition (bomblets, scatterable mines, and terminally guided submunitions).

Mission Area: Indirect artillery.

Level of Detail of Processes and Entities: The model represents the activities (movement, loading, and firing) of MLRS launchers (self-propelled launcher/loaders). The activities are driven by decisions that the user makes based on information presented to him on the status of his launcher assets and the requirements for targets to be engaged. The user also makes decisions relating to ammunition resupply.

CONSTRUCTION:

Human Participation: Required for decisions. Model can run in real time or wait for decisions and time-step on user input.

Time Processing: Dynamic, time-step (variable).

Treatment of Randomness: Deterministic (no randomness).

Sidedness: One-sided.

LIMITATIONS: No representation of communications delays or end effects.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Conversion to "C" programming language and amendments to user interface. Extensions to the models to make possible their use as command post exercises and to provide the core systems with more detailed training tools are planned. The use of the aids as tools for analysis of command decisions is also planned.

INPUT: Target stream defining arrival times, size, timeliness information, and type of ammunition required. Initial location of launchers (by 6-figure grid coordinates) and launcher data (speeds, etc.).

OUTPUT: Detailed events log of launcher activities and decisions made; summary statistics tables.

HARDWARE AND SOFTWARE:

Computer:	IBM PC-Compatible, DOS 3.
Storage:	Approximately 500 kbytes.
Peripherals:	None required, but a printer is useful for output.
Language:	Compiled Turbo BASIC. Currently converting to Microsoft "C."
Documentation:	Extensively documented, including full descriptions, specifications, and detailed user guide.

SECURITY CLASSIFICATION: UK Restricted.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Target stream scenarios require several man-days to set up.

CPU time per Cycle: N/A.

Data Output Analysis: Training performed during use of model; analysis of performance possible through output statistics.

Frequency of Use: Used regularly for training of officers.

Users: UK Royal School of Artillery, Larkhill; Army Personnel Research Establishment (APRE); 1 (BR) Corps, Germany (39th Heavy Regiment).

Comments: The MLRS Interactive Computer Aid is one of a family of command and control computer aids intended to give commanders an appreciation of the difficulties they are likely to encounter in controlling assets in complex scenarios. Further work is being performed to develop similar aids for use in casualty evacuation and civilian disaster planning

TITLE: Micro-FASTALS - Microcomputer Force Analysis Simulation of Theater, Administrative and Logistics Support

MODEL TYPE: Analysis.

PROPONENT: Forces Directorate, U.S. Army Concepts Analysis Agency, 8120 Woodmont Ave., Bethesda, MD 20814.

POINT OF CONTACT: Mr. Kenneth E. Allison, AV 295-0027.

PURPOSE: The objective of Micro-FASTALS is to develop balanced, time-phased support force requirements for a given combat force. Micro-FASTALS is primarily used for quick response, low-intensity force planning studies and analysis.

DESCRIPTION:

Domain: Land.

Span: Accommodates one theater at a time.

Environment: Theater dependent.

Force Composition: Used to generate requirements for Army support units.

Scope of Conflict: N/A.

Mission Area: Micro-FASTALS is a computer program based on LOTUS 1-2-3 and developed to generate the time-phased Army support requirements that result from a given combat simulation.

Level of Detail of Processes and Entities: Support requirements are generated for each unit type (functional area) including engineer, chemical, medical, etc. by SRC. The workload requirements needed to sustain the forces are also generated.

CONSTRUCTION:

Human Participation: Not permitted during execution.

Time Processing: Steady state.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Limited by the quality of input.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Complete user documentation.

INPUT: The following data bases in magnetic tape form are used: Military Traffic Management Command weights file and Army MARC Maintenance Data Base.

OUTPUT: Force listing is in the form of a time-phased troop list indicating requirements by SRC.

HARDWARE AND SOFTWARE:

Computer: IBM compatibles with 640k RAM.
Storage: N/A.
Peripherals: Printer.
Language: LOTUS 1-2-3 software and MS-DOS.
Documentation: Users manual under development.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Up to one man-month depending on size or force and complexity of theater.

CPU time per Cycle: Five minutes.

Data Output Analysis: Generally not more than two hours.

Frequency of Use: Used approximately five times per year.

Users: USACAA.

Comments: N/A.

TITLE: Micro-PFM - Microcomputer Patient Flow Model

MODEL TYPE: Analysis.

PROPONENT: Health Care Operations, Force Structure Branch, Office of the Surgeon General, 5109 Leesburg Pike, Falls Church, VA 22041-3258.

POINT OF CONTACT: MAJ Lee Hampton, USACAA, ATTN: CSCA-FOS, 8120 Woodmont Ave., Bethesda, MD 20814-2797.

PURPOSE: Micro-PFM provides a model for analyzing a multi-echeloned hospitalization system for a theater of operations. It provides the user with the distribution and disposition of hospitalized casualties given attrition rates, evacuation policies, and evacuation schedules.

DESCRIPTION:

Domain: Land.

Span: Accommodates 32 pairs of population and attrition rates (geography defined by user).

Environment: Theater and user defined.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: Micro-PFM is operated through user-friendly menus of questions and answers to patient distribution and disposition information for the medical operations analyst.

Level of Detail of Processes and Entities: User must define the populations at risk and their associated attrition rates for combat and noncombat (WIA and DNBI).

CONSTRUCTION:

Human Participation: Not permitted during model execution.

Time Processing: Depends on theater size (2 to 45 minutes).

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Limited by the quality of the input.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None at this time.

INPUT: User defined.

OUTPUT: Patient distributions by echelon and dispositions by echelon (remain in hospital, returned to duty, evacuated, etc.)

HARDWARE AND SOFTWARE:

Computer: IBM compatible (DOS 3.2) with 640K RAM.
Storage: N/A.
Peripherals: Printer (optional).
Language: FORTRAN.
Documentation: User manual published in 1987 at USACAA.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Several hours depending on the user's familarity with theater medical planning.

CPU time per Cycle: Two to 45 minutes depending on application and size of the theater to be modeled.

Data Output Analysis: Several hours depending on the user's familarity with theater medical planning.

Frequency of Use: Weekly.

Users: OTSG, AHS, USACAA, and other theater planners/MACOMS.

Comments: N/A.

TITLE: Micro SAINT

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Medical Research and Development Command, Walter Reed Army Institute of Research, ATTN: OMPAT, WASHINGTON D.C. 20307-0001

POINT OF CONTACT: Dr. Frederick Hegge, (301) ~~588-0058.~~ 576-1671

PURPOSE: Micro SAINT is a research and evaluation tool that deals with both systems effectiveness and systems development. It is a general purpose modeling tool designed to facilitate model development. It has been structured to facilitate the development of weapon system performance libraries and data bases for combat performance simulation.

DESCRIPTION:
Domain: Abstract; Micro SAINT can be used to model systems and interactions among systems in all domains.

Span: Primarily regional, local, or individual.

Environment: Determined by the user.

Force Composition: Primarily component or element, although it could be applied to broader problems.

Scope of Conflict: N/A.

Mission Area: Determined by the user; not inherently constrained by the model.

Level of Detail of Processes and Entities: Determined by the user.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic (Monte Carlo) or deterministic (user-selectable for any given run).

Sidedness: One-sided or two-sided.

LIMITATIONS: No more than 400 uniquely defined activities per model (although more can be defined on the VAX/VMS version). Note that activities performed many times only constitute one activity even if performed by different entities.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Version for the Macintosh under development; customized user interfaces and system performance libraries for specific DoD applications being built; and more sophisticated modeling features being added.

INPUT: Scenario, activities performed by each system type, and performance characteristics of systems.

OUTPUT: Raw data in ASCII files, as well as data plots, histograms, and descriptive statistics for any variables of interest.

HARDWARE AND SOFTWARE:

Computer:	IBM PC (MS DOS) and VAX (VMS).
Storage:	20 MB hard disk.
Peripherals:	IBM graphics-compatible computer.
Language:	No programming language required (one is built in).
Documentation:	N/A.

SECURITY CLASSIFICATION: None.

GENERAL DATA:

Date Implemented: February 1986.

Data Base: Depends upon the complexity of scenario. Models with only a few systems, each with under 20 activities, can be constructed in roughly one day.

CPU time per Cycle: This cannot be defined since model is event-driven.

Data Output Analysis: Roughly one hour to print all data and statistics.

Frequency of Use: Unknown.

Users: Army Research Institute, Walter Reed Army Institute of Research; Naval Aeromedical Research Laboratory; and a number of contractors.

Comments: Micro SAINT has only been in use for several years, but has generally been received positively by its users.

TITLE: MIDAS - Macintosh Interactive Display and Analysis System

MODEL TYPE: Analysis.

PROPONENT: CA1 Division, RARDE, Fort Halstead, Sevenoaks, Kent, England.

POINT OF CONTACT: PO/EWS, CA1 Division, RARDE, Fort Halstead, Sevenoaks, Kent, England. Tel: Knockholt (0959) 32222 Ext 2353.

PURPOSE: MIDAS is a system designed to display the output from EMSA, DAP, and the Electronic Warfare Simulation (EWS). It can also be used to generate static scenarios for the EWS.

DESCRIPTION:

Domain: Land.

Span: Terrain data base currently restricted to Central Europe 1(BR) Corps region, although could in principle cover any region in any theater.

Environment: Aggregated terrain (500-meter resolution). Spot height and cover data displayed from EWS terrain data base. Roads and rivers displayed via a digitized map.

Force Composition: RED and BLUE forces.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: DAP is designed to display unit locations, identities, and communications configurations from EMSA, DAP, and EWS output. Data may be displayed on individual units, groups of units meeting specified criteria, and particular types of communications links.

CONSTRUCTION:

Human Participation: Required.

Time Processing: Static.

Treatment of Randomness: N/A.

Sidedness: RED and BLUE.

LIMITATIONS: Cannot display emitter data from the EMSA, EWS, or DAP.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Inlcusion of emitter data, modifications to the user interface, and improvements to the scenario generation features.

INPUT: Output from EWS, EMSA, and DAP.

OUTPUT: On-screen display, printout, or computer file of unit identities, locations, and communications links.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a Macintosh II, IIx or IIcx computer with the Apple operating system.
Storage:	Minimum requirements: 2 MB main memory and 20 MB hard disk.
Peripherals:	Minimum requirements: one 19-inch color monitor and one printer.
Language:	MPW Pascal.
Documentation:	User guide, system description, and programmer guides.

SECURITY CLASSIFICATION: Classified.

GENERAL DATA:

Date Implemented: Current version: April 1989.

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: Output file for input to EWS, and output files for input into Macintosh spreadsheet.

Frequency of Use: As required.

Users: RARDE.

Comments: N/A.

TITLE: MIDLAAM - Midlevel Allocation and Assessment Model

MODEL TYPE: Analysis.

PROPONENT: Vulnerability Analysis Branch (C312), Joint Data Systems Support Center (JDSSC), The Pentagon, Washington, DC 20301-7010.

POINT OF CONTACT: Elliott Hunter, (202) 697-7421, AV 227-7421.

PURPOSE: The MIDLAAM process is a directed set of models and procedures that collectively represent a complete mid-level strategic force allocation and assessment model. MIDLAAM performs the following functions: target data preparation and aggregation, target response function generation, arsenal preparation and maintenance, and force allocation planning.

DESCRIPTION:

Domain: Land, air, and sea.

Span: Global.

Environment: N/A.

Force Composition: Combined forces.

Scope of Conflict: Nuclear weapons.

Mission Area: Strategic nuclear missions.

Level of Detail of Processes and Entities: Individual targets are input but are aggregated into target complexes/aimpoints and target groups. Target vulnerability determines survival probability.

CONSTRUCTION:

Human Participation: Required for data preparation and scenario decisions prior to execution.

Time Processing: Static.

Treatment of Randomness: Deterministic; generates a value as a function of an expected value.

Sidedness: One-sided.

LIMITATIONS: Data preparation is extensive, and targeting background is required to fully utilize model capabilities.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Improve file handling structure and enhance measures of effectiveness.

INPUT: Includes arsenal, target, and scenario data. Attack strategies are also required.

OUTPUT: Aggregated target files, detailed statistical and allocation steps, strike file, and error reports.

HARDWARE AND SOFTWARE:

Computer: IBM 4341 operation under CMS.

Storage: 6 MB core required to run specific section of the systems.

Peripherals: Printer, terminal (runs interactively with user), and disk storage device.

Language: FORTRAN 66.

Documentation: MIDLAAM user's guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Two to three weeks.

CPU time per Cycle: Five to 60 minutes CPU depending on file size and complexity of allocation.

Data Output Analysis: Statistical summaries and reports provide quick access to results.

Frequency of Use: Three studies per year.

Users: Office of the Assistant Secretary of Defense, International Security Policy (OASD/ISP) and Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (OASD/PA&E).

Comments: N/A.

TITLE: MINDSIM - Mine Deployment Simulation Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Engineer Waterways Experiment Station, ATTN: CEWES-EN-A, P.O. Box 631, Vicksburg, MS 39181-0631.

POINT OF CONTACT: Phillip L. Doiron, (601) 634-3855.

PURPOSE: MINDSIM is used primarily to analyze the deployment performance of remotely delivered, scatterable mines in realistic terrain and environmental conditions. The model presently simulates the deployment of all U.S. scatterable mine systems and will have the capability in the near future to simulate the deployment performance of foreign scatterable mine systems. MINDSIM can be used to produce tactical decision aides for a battlefield commander.

DESCRIPTION:

Domain: Land.

Span: Based on 1:50000 scale map quadrangle.

Environment: Grid-based. Each 100m grid cell contains the terrain and environmental descriptions of the area. These terrain descriptions can include the topographic elevation; vegetation type, height, and density; soil type and moisture content; water depth, width, and velocity; urban structure height and density; and road type and width. The environmental descriptions can include the type and amount of precipitation and the snow depth.

Force Composition: Mine system assets, both BLUE and RED.

Scope of Conflict: Conventional and unconventional.

Mission Area: Mining operations.

Level of Detail of Processes and Entities: The performance of each individual mine system is simulated. The simulation is geared primarily to analyze the interactions of the mines with the terrain and environmental conditions occurring in the selected minefield areas. The minefields can be located anywhere on a 1:50000 scale map quadrangle and can be of any size up to the size of the terrain data base.

CONSTRUCTION:

Human Participation: Required to select the mine system parameters.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided. symmetric.

LIMITATIONS: Does not take into account any mine system delivery errors. Mines are assumed to be placed into the designated minefield area.

PLANNED IMPROVEMENTS AND MODIFICATIONS: In the near future, foreign scatterable mine systems and the U.S. Wide Area Mine will be included. MINDSIM will be implemented on an MS DOS-based PC.

INPUT: Relevant terrain and environmental factors and mine system characteristics.

OUTPUT: Produces graphical display and tabular printouts of mine performance.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a MicroVAX computer with VMS operating system.
Storage:	8.5 MB required to run the model.
Peripherals:	Minimum requirements: 1 printer, 1 Raster 380 graphics terminal, 1 VT100 terminal.
Language:	FORTRAN.
Documentation:	Documented with five published reports.

SECURITY CLASSIFICATION: Model is unclassified, but some data and model outputs are classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: 3 months to prepare digital terrain data base.

CPU time per Cycle: 31.72 seconds.

Data Output Analysis: Manual.

Frequency of Use: Used whenever required to support research and development efforts.

Users: U.S. Army Engineer Waterways Experiment Station.

Comments: Model has been activated on the AirLand Battlefield Environment Test-Bed System. Interest in the model has been expressed by personnel at TRAC-WS.

TITLE: Minotaur

MODEL TYPE: Analysis.

PROPONENT: Studies, Concepts and Analysis Division, Logistics Directorate (J-4), The Joint Staff, The Pentagon, Room 2E827, Washington, DC 20318-4000.

POINT OF CONTACT: CDR K. J. Kelley, (202) 696-6110, AV 225-9212.

PURPOSE: Minotaur is an intertheater strategic deployment model and data management system. It is a research and evaluation tool that can be used to determine mobility force capabilities or requirements. Minotaur is intended for use in situations where a quick analysis of a problem using a highly aggregated and simplified representation of a deployment is sufficient.

DESCRIPTION:

Domain: Sea and air; limited land operations.

Span: Can accommodate global or any variety of intertheater movements.

Environment: Network-based air and sea movement.

Force Composition: Includes all unit and nonunit personnel and equipment required for deployment.

Scope of Conflict: Simulates only the deployment phase of a conflict. Presently used only for conventional wargaming and planning.

Mission Area: Intertheater mobility (airlift and sealift).

Level of Detail of Processes and Entities: Each unit to be moved is characterized by amounts of various equipment and supplies to be deployed, number of personnel, specific origin and destination, availability date reflecting readiness to deploy from the origin, and required delivery date at the destination. The transportation system assets may be mobilized at different times and rates. The aircraft and ships used for deployment are characterized by their speed, cargo-carrying capacity, and cargo-handling characteristics. Ships are individually described. Aircraft are tracked by type.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-step and event-step.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Maximum values on key parameters, such as number of requirements (2975) result in a relatively first-cut analysis of intertheater deployment. Minotaur does not simulate port or airfield operations at either end of the deployment pipeline, nor does it simulate convoys or ships or attrition of aircraft and ships.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Input editor being enhanced.

INPUT: Uses six major input data files: scenario data, network data, aircraft data, ship data, requirements data, and consumption rate data.

OUTPUT: Can produce output in report, tabular, and graph form. Report-generating routines allow the user to select a subset of movements generated by the model, sort them in any order, and generate tabular reports. Minotaur also provides an extensive set of screen graphics including pie charts, line charts, flat and three-dimensional bar charts, and stacked line and bar charts.

HARDWARE AND SOFTWARE:

Computer:	IBM PC or compatible with one hard disk drive and one floppy disk drive, a color/graphics display board, and an 8087 math coprocessor.
Storage:	640K memory.
Peripherals:	Monochrome or color monitor and printer.
Language:	Turbo Pascal Version 4.
Documentation:	User's Manual for the Minotaur System, October 1988, published by General Research Corporation.

SECURITY CLASSIFICATION: Unclassified (without data).

GENERAL DATA:

Date Implemented: N/A.

Data Base: Preparation of meaningful data bases can take several man-weeks and requires a significant level of technical and functional expertise.

CPU time per Cycle: Depends on data base size and scenario inputs. Small data bases can be processed in 5 to 10 minutes of CPU time.

Data Output Analysis: Immediate to two man-weeks (depending on complexity).

Frequency of Use: Infrequently used for logistic simulation.

Users: OSAD(PA&E), JDSSC, JCS (J-4).

Comments: N/A.

TITLE: MME - Mobilization Model

MODEL TYPE: Training and education.

PROPONENT: War Gaming and Simulation Center, Institute for National Strategic Studies, National Defense University (NDU-NSS-WGSC), Ft. McNair, Washington, DC 20319.

POINT OF CONTACT: R. D. Wright, (202) 475-1251, AV 335-1251.

PURPOSE: To help teach the structure of the military manpower system and to illustrate costs and wartime manpower yields of key peacetime, mobilization, and wartime personnel policies. Off-line discussions of qualitative, military judgement issues (force readiness, cohesion, equity, political feasibility) are an essential component of this model.

DESCRIPTION: The model implements any of a set of 40 policies and assumptions dealing with decisions in peacetime, mobilization, or wartime. Examples include the extent of female participation, the percent wartime manpower requirement authorized, and the level of recruiting effort in peacetime; time-phasing of Individual Ready Reserve or retiree call-ups at mobilization; choices about undermining CONUS units to provide fillers; or medical discharge standards in wartime. For enlisted members of all four services, the model calculates recruiting, retention, interservice competition, and force sizes and quality during a five-year peacetime planning horizon. After M-Day it calculates (in 10-day intervals) army combat and army support enlisted manpower supply, demand, and shortfalls. The deployment schedule for forces to fighting theaters and the casualty profile are fixed by the scenario. This exercise does not allow for prosecuting the war differently (although users can experiment with different casualty scaling factors).

Domain: N/A.

Span: Up to three theaters with wartime combat operations: CONUS nondeploying (strategic reserve), CONUS training base forces, and the rest of world.

Environment: N/A.

Force Composition: In peacetime: enlisted personnel for Navy, USMC, and Air Force; Army enlisted higher risk (e.g., combat arms) personnel; and Army enlisted lower risk (e.g., service support) personnel.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: N/A.

CONSTRUCTION:

Human Participation: Policy specification and assessment of qualitative, judgmental factors.

Time Processing: Five-year peacetime calculations in quarterly time steps. 180-day war in 10-day time steps.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Limited treatment of officers and DOD civilians. No play of Coast Guard. Aggregation of Navy, Marine, and Air Force enlisted personnel into a single category masks wartime shortfalls in particular specialities.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Data base revisions, extended policy set, and improved screen input.

INPUT: Policy specification.

OUTPUT: Peacetime costs, recruiting success and force quality measures, and mobilization assets for four services. Wartime army enlisted supply and demand and shortfall profile. The model provides a list of flags, noting qualitative considerations involved with policies selected that require professional military judgment and evaluation.

HARDWARE AND SOFTWARE:

Computer:	A Z-248/IBM-AT or clone with 640K memory.
Storage:	Can run from a floppy disk.
Peripherals:	Printer.
Language:	N/A.
Documentation:	Manpower Mobilization Exercise and Model User's Guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1981.

Data Base: One week effort to specify an exercise scenario.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: Twice per year.

Users: NDU Industrial College of the Armed Forces and the Army War College.

Comments: Source code maintained at NDU-NSS-WGSC.

TITLE: MPRES - Method for Presenting Received Signals

MODEL TYPE: Analysis.

PROPONENT: USCINCPAC Staff (J55), Box 15, Camp H. M. Smith, HI 96861-5025.

POINT OF CONTACT: Mr. Ronald H. Uyehara, (808) 477-6467, AV (315) 477-6467.

PURPOSE: For a given air defense situation, MPRES is used to determine the times at which each target is detected or redetected by each radar, the times at which each target is lost by each radar because of fade or terrain masking, and the length of each radar track. The primary use of MPRES at USCINCPAC is to generate "detect/leave" events for the MABS-EX air defense model. It is also, however, used to determine radar detection ranges in the presence of noise jamming.

DESCRIPTION:
Domain: Air. MPRES models the airspace needed to simulate the coverage of a radar network. The geographical area that can be considered is limited only by the extent to which the earth's surface can be approximated by a rectangular coordinate system.

Span: Local and regional. Simulations with greater span are limited by the number of entities simulated and position errors caused by projecting spherical coordinates onto a planar surface.

Environment: Smooth earth with provisions for radar masking at 15-degree increments.

Force Composition: Aircraft flight paths and radar network types and locations.

Scope of Conflict: Conventional.

Mission Area: Air defense.

Level of Detail of Processes and Entities: Single aircraft flight paths and single radar coverage. Aircraft detection is modeled at the radar equation level with a step function detection threshold.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: ECM limited to noise jamming only.

PLANNED IMPROVEMENTS/MODIFICATIONS: Rehost to SUN 3/260 system.

INPUT: Aircraft flight path; aircraft radar cross section as a function of aspect in three dimensions; jammer power and antenna pattern as a function of aspect in three dimensions; radar antenna pattern in three dimensions; and radar vertical and horizontal beamwidths, PRF, receiver noise figure, and power.

OUTPUT: Coded printout with time on the abscissa and radars listed on the ordinate. For each flight path, the display shows the times at which the aircraft is detected by each radar and the times at which it is not detectable.

HARDWARE AND SOFTWARE:
- Computer: Wang VS80B (OS 6.4); VAX 8650 (VMS 4.6).
- Storage: 5 MB.
- Peripherals: Interactive terminal, printer.
- Language: FORTRAN IV.
- Documentation: User manual available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: Unknown.

Data Base: 3 to 5 days.

CPU Time per Cycle: 1 to 3 hours.

Data Output Analysis: Variable.

Frequency of Use: As needed.

Users: USCINCPAC; U.S. Forces Japan; Japan Self Defense Forces.

Comments: None.

TITLE: MRM - Medical Regulating Model

MODEL TYPE: Training and education (support of seminar war games).

PROPONENT: Wargaming Department, Naval War College.

POINT OF CONTACT: Micromodels Manager, (401) 841-3276, AV 948-3276.

PURPOSE: MRM models land combat casualty and return to combat rates. It is designed to support logistics assessment in larger-scale war games.

DESCRIPTION:

Domain: Land.

Span: Theater.

Environment: N/A.

Force Composition: Theater-level ground forces.

Scope of Conflict: N/A.

Mission Area: Logistics.

Level of Detail of Processes and Entities: User defines combat force size, combat intensity, hospital locations and capacities, and casualty transportation distances. "Snapshots" of personnel status are provided as per user-specified times (days).

CONSTRUCTION:

Human Participation: Initial inputs and iterative time-step specification.

Time Processing: Dynamic, time-step model.

Treatment of Randomness: Stochastic, with Monte Carlo determination of results.

Sidedness: One-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None anticipated.

INPUT: Hospital type (combat or communication zone), bed capacity and availability, geographic location, evacuation capability, casualty population, combat intensity, evacuation delays, and distances specified for each hospital. Casualty rates (killed and wounded as function of combat intensity, death due to wounds) are specified for each combat-intensity level. The disease and injury rate and the recover and return to duty rate are user-specified globally. User sequentially specifies time period (days) to be modeled.

OUTPUT: Status of all or any of the parameters input. If multi-day time-step selected, user may specify day-by-day output or end-of-period status only. Output may be sent to screen, printer, or written to data files.

HARDWARE AND SOFTWARE:

Computer: IBM-compatible PC with 512K RAM.
Storage: N/A.
Peripherals: N/A.
Language: FORTRAN 77.
Documentation: User's manual, source code.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: September 1988.

Data Base: 30 minutes.

CPU time per Cycle: 15 seconds.

Data Output Analysis: "Snapshot" of casualty numbers and locations.

Frequency of Use: Several times per year anticipated.

Users: Wargaming Department, Naval War College.

Comments: MRM is designed to provide theater-level land combat casualty accounting in support of larger-scale war games.

TITLE: MSEPAM - Mobile Subscriber Equipment Performance Analysis Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Electronic Proving Grounds, ATTN: STEEP-(T-E), Ft. Huachuca, AZ 85613-7110.

POINT OF CONTACT: Mr. Steven C. Cooper, (602) 538-4953, AV 879-4953.

PURPOSE: The MSEPAM is an operational support tool used to provide a means for estimating the MSE system performance under various operational and environmental conditions.

DESCRIPTION:
Domain: Land only.

Span: Can accommodate any corps depending on data base.

Environment: Detailed, radio frequency, phonemology model. Models effects of terrain and ground constraints in either an area predictions or point-to-point mode. User or Defense Mapping Agency-digitized terrain data as input.

Force Composition: Joint and combined, BLUE and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All phases of conventional warfare.

Level of Detail of Processes and Entities: MSEPAM is capable of modeling a range of complexity from a single radio transmitter to all the radios used by an entire army. Movement of MSE subscribers, background C-E emitters, turn-on/turn-off of EW, reliability-availability-maintainability (RAM) events and attrition are handled by the MSEPAM logic.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Dynamic, time-step and event-step.

Treatment of Randomness: Can be run in either deterministic or probabilistic mode. Monte Carlo options are available for estimating propagation variations about the mean.

Sidedness: N/A.

LIMITATIONS: Does not model specific effects of foliage or urbanization.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Studies are underway to further reduce CPU time, to imporve the user interface and to enhance MSEPAM's flexibility in addressing users' applications.

INPUT: Tactical deployment data, equipment technical performance characteristics, propagation path loss parameters, and MSE system-specific timing and performance data.

OUTPUT: Printout containing the signaling and timing delays and the message traffic through the system when the MSE is operating in its intended tactical operational environment.

HARDWARE AND SOFTWARE:

Computer:	CYBER 180 Model 830, Network Operating System Level 700.
Storage:	Variable, requirements can be adjusted. Currently using 376,500 words of central memory and 2.04 million words of extended memory adjusted according to deployment size.
Peripherals:	Optimum number of disk and tape drives varies, variable mass storage requirements, size of data files determines requirements.
Language:	SLACS 5 (an extended FORTRAN 77).
Documentation:	Minimum available, being prepared.

SECURITY CLASSIFICATION: Unclassified, but data bases are classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Preparation of complete new corps-size deployment with appropriate RED forces requires one year. Analysis requiring data modification for specific changes requires one to two months depending on extent of changes.

CPU Time per Cycle: Dependent on deployment size and equipment to be evaluated. CORPS size deployment can take 9.0/25.0 hours of CPU time per hour of simulation time for benign/EW analyses.

Data Output Analysis: Hard copy printouts.

Frequency of Use: Currently being used for the first time.

Users: USAEPG.

Comments: The model is not machine dependent. However, it does take advantage of the CDC CYBER 60-bit word for optimization of data storage and access.

TITLE: MULTI-ASPIC - Multiple AWACS Simulation: Penetrator/Interceptor Combat Model

MODEL TYPE: Analysis.

PROPONENT: Boeing Military Airplanes, Operations Analysis Organization, P.O. Box 7730, M/S K80-33, Wichita, KS 67277-7730.

POINT OF CONTACT: Joetta C. Mark, (316) 526-2810.

PURPOSE: MULTI-ASPIC is used for the evaluation of engagements between penetrators and AIs directed by an AWACS. The model simulates the capabilities of AWACS airborne radar platforms as they direct fighters to intercept penetrating aircraft. Up to 10 surveillance and orbital areas may be defined. The simulation considers the following major interactions: AWACS and AI, AWACS and penetrator, and AI and penetrator. Specifically, it determines the possible times, angles, and coordinates at which an AWACS-directed interceptor detects and kills a penetrator that is under surveillance of the controlling AWACS.

DESCRIPTION:

Domain: Air (land in terms of aircraft basing only).

Span: The model is used in mission segment studies and analyses involving penetration through multiple AWACS surveillance areas.

Environment: Limited terrain features as they affect aircraft detection capabilities.

Force Composition: BLUE and RED air elements, including fighters, bombers, and AWACS.

Scope of Conflict: Conventional weapons include air-to-air missiles, guns, and ALCMs. No nuclear or chemical effects are considered.

Mission Area: Bomber Penetration through AWACS Surveillance.

Level of Detail of Processes and Entities: Movement is modeled for each individual player, including penetrators, ALCMs, AIs, and AWACS. MULTI-ASPIC is a many-on-many model with a one-on-one end game. Both AWACS to AI and AWACS to AWACS communication is modeled, but penetrating aircraft can be given the ability to jam any communications. The model simulates both electronic and deceptive countermeasures that can be used by the penetrators against both AI and AWACS platforms. Player attrition is determined by random draws against pK information when air-to-air missiles are launched or airborne guns are used.

CONSTRUCTION:

Human Participation: Required for input data base preparation and mission planning only. After execution begins, human participation is not normally allowed.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo determination of player attrition based on pK.

Sidedness: Two-sided, asymmetric, reactive model.

LIMITATIONS: Does not simulate missile flyout for air-to-air missiles. Penetrator weapons are considered only as generic bomber defensive weapons. AI autonomous activity is not allowed.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Add calculations for missile flyout and provide for autonomous AI activity.

INPUT: Penetrator sorties, AWACS orbits, AI and AWACS base locations, weapon loading and launch parameters, basic flight parameters for all players, penetration aids and tactics, AWACS interceptor assignment and operational rules, AWACS and AI detection capabilities, and cruise missile launch points.

OUTPUT: Number of geometry for both AWACS and AI detections, engagement geometry at weapon release, player survival results, and complete, time-ordered event trace.

HARDWARE AND SOFTWARE:

Computer:	APOLLO Workstations with a DOMAIN/IX operating system. (Previously executed on VAX 11/780 computer with VMS).
Storage:	750K bytes, including input files.
Peripherals:	None necessary. 1 printer if hard copy is desired.
Language:	FORTRAN IV and FORTRAN 77.
Documentation:	Multiple AWACS Simulation: Penetrator/Interceptor Combat (MULTI-ASPIC) Model User/Analyst Manual--10/2/87.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Parametric Inputs - 2+ weeks. Tabular data may take several months to collect or generate.

CPU time per Cycle: Dependent on data base size and numbers of players. A typical scenario can take 3 or more hours.

Data Output Analysis: Postprocessors aid in condensing and analyzing output.

Frequency of Use: Varies by priority and requirements, but has been used for three or more studies in 1988.

Users: BMA, Operations Analysis.

Comments: Graphical data may be output and used as input to the Map Generation Model to describe penetrator routes and AWACS surveillance areas. The MULTI-ASPIC model is an upgraded version of the single AWACS ASPIC model which has been maintained and used since 1969 by the OA organization. In 1981 the model was modified to include ALQ-172 effectiveness for penetration analysis. Penetrator lethal defense was incorporated in 1986.

TITLE: MULTIWAR - Multiwarfare Scoping Model Version 2.0

MODEL TYPE: Analysis.

PROPONENT: Space and Naval Warfare Systems Command (SPAWAR ~~31F~~ 301), Washington, DC. 20361-5000

POINT OF CONTACT: CDR John Casko, SPAWAR 31F1. (202) 692-4512 AV 222-4512

PURPOSE: The MULTIWAR spreadsheet is a top-level, expected-value analysis tool designed to provide an overview of large-scale naval multiwarfare scenarios including ASW, AAW, and strike engagements. These specific areas are individually modeled, and are combined in a full-scale model of a wargaming scenario.

DESCRIPTION:

Domain: Undersea, sea, air, and land.

Span: Accommodates any theater depending on data inputs.

Environment: Environmental factors do not appear as direct inputs, although performance inputs for forces under environmental stress may be manipulated to reflect affected performance.

Force Composition: Combined forces, RED and BLUE.

Scope of Conflict: Primarily conventional, but nuclear weapons are possible.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: This model will handle forces from the platform level to the individual elements of ships, aircraft, submarines, or strike targets. Inputs associate all elements of the same type (all aircraft off a certain ship) with the same properties of detection, classification, targeting, and attack. Attrition, however, is at the aggregate level.

CONSTRUCTION:

Human Participation: Required for decisions and processes. The model contains specified breakpoints where the user has the option to direct the play or survey intermediate results.

Time Processing: Static; user has control of event sequencing and may direct according to a given scenario. Events always continue through completion once initiated.

Treatment of Randomness: Deterministic, expected value.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Does not model surface-to-surface naval engagement or mine warfare.

PLANNED IMPROVEMENTS AND MODIFICATIONS: TBD.

INPUT: The spreadsheet requires the number and type of all elements for the RED and BLUE forces; weapons loadouts and effectiveness factors; movement probabilities such as detection, classification, and attack; countermeasure probabilities; and weapon distribution.

OUTPUT: Computer printouts, plots, and intermediate totals are available for the user through EXCEL standard features.

HARDWARE AND SOFTWARE:

Computer:	Apple Mac II or Mac Plus.
Storage:	Hard drive not required but operationally necessary for productive use of the model.
Peripherals:	Printer for results if desired. EXCEL Version 1.06 must be resident.
Language:	Microsoft EXCEL Version 1.06.
Documentation:	User's guide available. Analyst's Mamanual under development.

SECURITY CLASSIFICATION: Unclassified without data.

GENERAL DATA:

Date Implemented: September 6, 1988.

Data Base: Inputs for a new scenario could take man-months. Alterations to existing data bases could be performed much more quickly.

CPU time per Cycle: Depends on data input and machine type; generally less than fifteen minutes.

Data Output Analysis: Analysis performed by operator using intermediate and final data from model calculations.

Frequency of Use: N/A.

Users: SPAWAR 31F architecture community including NOSC, NUSC, NSWC, and other navy labs and contractors.

Comments: N/A.

TITLE: MUPPET - Multi-Purpose Performance Evaluation Tool

MODEL TYPE: Analysis.

PROPONENT: Vitro Corporation, 14000 Georgia Ave., Silver Spring, MD 20906.

POINT OF CONTACT: A. J. Ondrish, (301) 231-2097.

PURPOSE: The purpose of MUPPET is to display and provide an assessment or profile of the capability of AEGIS surface ship's combat system in the three warfare areas: AAW, ASU, and ASW.

DESCRIPTION:

Domain: Sea.

Span: Global.

Environment: Models existing state; portrays status.

Force Composition: One ship.

Scope of Conflict: Conventional.

Mission Area: AAW, ASU, and ASW.

Level of Detail of Processes and Entities: Uses Lotus 1,2,3 spreadsheet as an analytical framework to display the status of an AEGIS surface ship's combat system. Takes equipment status and produces computer displays such as graphs, bar charts, lists, and profiles in each warfare area. This model was developed as a research tool and a forerunner to other models and projects. It is now useful for demonstrations and for producing graphical displays of a ship's effectiveness.

CONSTRUCTION:

Human Participation: Required.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: One-sided/status display.

LIMITATIONS: Graphics and spreadsheet only.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None currently planned.

INPUT: All systems and equipment status.

OUTPUT: Graphics, as needed.

HARDWARE AND SOFTWARE:

Computer: IBM PC.
Storage: N/A.

Peripherals: Printer.
Language: Lotus 1,2,3.
Documentation: Notes.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1986.

Data Base: N/A.

CPU time per Cycle: One minute or less.

Data Output Analysis: Hard copy available.

Frequency of Use: Occasionally.

Users: Vitro Corporation (in-house).

Comments: MUPPET was developed as a research tool.

TITLE: NADM - NORAD Air Defense Model

MODEL TYPE: Analysis.

PROPONENT: HQ NORAD/~~NPY~~ J5Y, Peterson AFB, Co. 80914 - 5002.

POINT OF CONTACT: William R. Fischer, AV 692-3755; Kathie Reece, AV 692-3781.

PURPOSE: NADM is a force capability model. It is used to determine first order effects of changes in performance, effectiveness, deployment, and employment of existing and proposed air defense systems.

DESCRIPTION:

Domain: A discrete global model that includes land, sea, air, and space.

Span: Global.

Environment: Smooth, spherical earth assumed.

Force Composition: Any mix of air defense system.

Scope of Conflict: Weapons effects not important.

Mission Area: Strategic air defense.

Level of Detail of Processes and Entities: One aircraft and one missile.

CONSTRUCTION:

Human Participation: Human participation confined to impact stage.

Time Processing: Dynamic, event-step.

Treatment of Randomness: NADM is primarily Monte Carlo.

Sidedness: Two-sided, but the attacker is nonreactive.

LIMITATIONS: No Damage to defending forces. Command and control not modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Currently being ported to the SUN. Graphical postprocessing being designed. Inclusion of interactive decision making being considered.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer:	VAX and PCs.
Storage:	N/A.
Peripherals:	N/A.
Language:	SIMSCRIPT.
Documentation:	N/A.

SECURITY CLASSIFICATION: Model is unclassified.

GENERAL DATA:

Date Implemented: 1968.

Data Base: Requires one day to one week to prepare inputs.

CPU time per Cycle: Variable CPU time; 30 minutes on a VAX 11-785.

Data Output Analysis: Output well summarized. We use the model weekly. This model was the basis for STRATDEFENDER and is widely used.

Frequency of Use: N/A.

Users: N/A.

Comments: N/A.

TITLE: NAM - Network Assessment Model

MODEL TYPE: Analysis and education.

PROPONENT: U.S. Army Signal School, Fort Gordon, GA 30905.

POINT OF CONTACT: CPT Anthony Tabler, (404) 791-3782, AV 780-3782 or Mr. Jim Malcom, Teledyne Brown Engineering Project Manager, (205) 726-2781.

PURPOSE: As an analysis tool, NAM deals with force communications effectiveness and combat development doctrine evaluation. As a training and education tool, NAM develops the skills of the C3I planners in general, and the skills of the communications planner in detail.

DESCRIPTION:

Domain: Air and land.

Span: Army brigade to theater.

Environment: Uses terrain elevation data for communications propagation and displays cultural features for analytical uses.

Force Composition: Army, joint or combined.

Scope of Conflict: Electronic warfare only. Effects of attrition from other effects may be entered against the force or the communications model.

Mission Area: C3I.

Level of Detail of Processes and Entities: Several levels of detail possible. The fundamental entities are BLUE OPFACs, BLUE communications OPFACs, and RED EW OPFACs. OPFACs can be defined at any level from team to major theater command centers. OPFACs may be aggregated into super OPFACs if needed. Force effectiveness modeled as a function of communications performance. This performance is based upon four stress factors: battlefield activity including movement, threat activities including EW and attrition, physical properties including electromagnetic propagation, and force traffic.

CONSTRUCTION:

Human Participation: Required for graphical processes for scenario construction; not required, however, during run. The output viewing processes are also highly interactive.

Time Processing: Event-step with a clock interval of 10 milliseconds.

Treatment of Randomness: Traffic modeling is stochastic. Other stress factors are deterministic.

Sidedness: One-sided.

LIMITATIONS: The models limitations are:

	Current	Future
OPFACs	1000	8000
MSE Nodes	100	100
TRITAC Nodes	50	50
Extensions	200	250
Radio nets	100	100
Radios/net	30	30
JTIDS nets	10	10
EPLRS nets	8	8
EPLRS comm	1	5
Jammers	100	100
Map size	5x8	5x8

PLANNED IMPROVEMENTS AND MODIFICATIONS: Addition of packet switch scattering, frequency management tools, and tropospheric scattering model. A fifth stress factor is anticipated.

INPUT: Force list, CDB, and program of battlefield activity using interactive graphics.

OUTPUT: Playback of scenario over tactical situation; playback of network actions including traffic; and statistical analysis function for stress impacts by OPFAC, network, battlefield functional area, and architecture.

HARDWARE AND SOFTWARE:

Computer: Silicon Graphics 3100 series workstations w/UNIX OS. Porting in progress for Silicon Graphics 4D series workstations. Nongraphic processes (actual simulation run modules) portable to almost all UNIX-based machines with K&R "C" Compiler. No current graphics process portability.

Storage: 100 MB.

Peripherals: None required; printer and graphics screen printer recommended.

Language: "C" (K & R standard).

Documentation: Functional description, users manual, and programmers maintenance manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 25 June 1986

Data Base: Army OPFAC data base and Army CDB are used to drive the model.

CPU time per Cycle: Unknown at this time.

Data Output Analysis: Unknown at this time.

Frequency of Use: N/A.

Users: U.S. Army Signal School and Tactical Missile Defense Program.

Comments: Twelve hours of simulation requires two weeks of preparation, eight hours of run time (variable).

TITLE: NAVMOD - Naval Model

MODEL TYPE: Analysis.

PROPONENT: The Joint Staff, Force Structure, Resource, and Assessment Directorate (J-8), Capabilities Assessment Division (CAD), The Pentagon, Washington, DC 20318-8000.

POINT OF CONTACT: Naval Analysis Branch, CAD, (202) 695-9145.

PURPOSE: NAVMOD is a theater-level model designed to evaluate the combat outcomes of naval force interactions used for various Joint Staff assessments. It is a research and evaluation tool that deals with force capability and requirements, particularly used for courses of action assessment.

DESCRIPTION:

Domain: Air and sea, as related to naval forces. Geographical considerations of opposing forces are not considered explicitly but maybe included implicitly by adjusting combat factors as the geography alters the capability of weapons platforms.

Span: Theater or regional.

Environment: Parameters must be adjusted to reflect specific environments; accordingly, the model can adapt to any environment.

Force Composition: The BLUE forces can consist of aircraft carriers, escort ships, other surface ships, submarines sea-based attack and fighter aircraft, sea-based land-attack cruise missiles, and land-based naval aircraft. The RED forces can consist of surface ships (and associated aircraft), submarines, land-based attack and defensive aircraft, and ground defense.

Scope of Conflict: Conventional.

Mission Area: All conventional naval engagement, except mine warfare.

Level of Detail of Processes and Entities: Numbers of types of aircraft, ships, and submarines that can be input is adequate for present force structures. The model aggregates platform performance parameters into one generic capability, as instructed by the analyst.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic, time- and event-stepped model. Progresses through events at a user-specified ratio of model time to real time.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, symmetric, reactive model.

LIMITATIONS: Command, control, communication, intelligence, electronic warfare, and mine warfare are not explicitly modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Requires that the orders of battle for both sides and the factors describing the combat capabilities of all force be entered. Geographical considerations of the opposing forces are not considered but may be included implicitly by adjusting the combat factors as the geography alters the capability of the weapons platforms. The model includes a single preprocessor to facilitate inputs.

OUTPUT: Reports on the status of forces after each combat interaction (i.e., submarine versus submarine, surface force versus air, etc.). These reports give the expected value of the number of platforms remaining at full strength. A summary report that gives the expected results after each time period is included.

HARDWARE AND SOFTWARE:

Computer:	VAX with VMS operating system.
Storage:	100,000 blocks preferred; includes room for data.
Peripherals:	1 printer, 1 VT-100 terminal.
Language:	FORTRAN IV, INGRES.
Documentation:	Extensive manuals.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: March 1983.

Data Base: Population of large data bases can take several man-years.

CPU time per Cycle: 45 to 90 seconds.

Data Output Analysis: N/A.

Frequency of Use: Approximately 200 times a year.

Users: CAD/J-8, IDA.

Comments: A mature naval model that requires operator familiarity to be most effective.

TITLE: NEST - Naval Exercise Support Tool

MODEL TYPE: Training and education (with limited analytical capability).

PROPONENT: Naval Space Command, Dahlgren, VA 22448-5170.

POINT OF CONTACT: Maj. M. J. Kramer, 703-663-2677, AV 249-7876.

PURPOSE: NEST models the interactions between satellites and objects on or near the surface of the earth. This modeling allows rapid modeling of the architecture and effectiveness of space-based radar, etc. and an assessment of the systems effectiveness in terms of percent coverage, satellite sensor dwell times, gap times, and ratios. As a training and education tool, NEST develops the skills of individuals. As an operations support tool, it aids in decision making.

DESCRIPTION:

Domain: Space, earth surface, and near-earth surface.

Span: Global, with the ability to focus on areas smaller than a theater.

Environment: Topographic features and average sea depth extracted from the World Data Base II map system can be displayed but are not considered in the movement of tracks or the propagation of emissions.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: NEST does not model conflict or weapons systems.

Mission Area: The analysis from NEST is primarily used for sea control and strike planning. It can be used with any warfare area in planning for satellite coverage or satellite avoidance.

Level of Detail of Processes and Entities: The lowest entity modeled is the individual ship, aircraft, or radar against the individual satellite. The analysis of the interaction between satellites and objects on or near the surface of the earth considers communications between satellites and ground sites as well as the movement of the satellites and the near-earth surface objects.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-step, where the size of the time-step can be defined by the operation.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: NEST assumes linear propagation of radio waves (no refraction or reflection), and assumes a smooth earth (no topography).

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Satellite models, satellite ephemeris data, near-earth surface objects emitter characteristics, locations, courses, and speeds.

OUTPUT: Computer printouts or plotter printouts and statistical summaries.

HARDWARE AND SOFTWARE:

Computer:	Hewlett Packard model 9020.
Storage:	Minimum storage 15 MB or hard disk memory space.
Peripherals:	A graphics plotter, a graphics printer, a digitizer pad, serial outputs, and an RGB output.
Language:	Rocky Mountain BASIC.
Documentation:	Very limited; classified. Contact the point of contact for details.

SECURITY CLASSIFICATION: Unclassified, but data bases are at least secret.

GENERAL DATA:
Date Implemented: 20 February 1989.

Data Base: Initial data bases are provided with the model. The time required to modify and update them depends upon the level of complexity of the problem, but averages less than one hour.

CPU time per Cycle: Depends upon the level of complexity of the problem, but averages less than one hour.

Data Output Analysis: Produces hard copies of satellite pass times.

Frequency of Use: Varies by command.

Users: JEWC, Naval War college, Naval Post Graduate School, CINCSPACE, Naval Space Command, and Carrier Air Groups.

Comments: NEST linked to Prototype Ocean Surveillance Terminal (POST) and Prototype Analysts' Work Station (PAWS).

TITLE: NETS - Netted EW/GCI Tracking System Model

MODEL TYPE: Analysis.

PROPONENT: Operations Analysis Staff, Boeing Military Airplanes, Wichita, KS.

POINT OF CONTACT: Mr. D. Moore 316-526-2021.

PURPOSE: The Netted Early Warning Ground Control Interceptor Radar Tracking System Model is a simulation computer program written in FORTRAN and designed to evaluate the ability of an air defense complex (such as a logically communications netted EW/GCI ground radar system) to vector airborne interceptors to the vicinity of a penetrating aircraft.

DESCRIPTION:
Domain: Land and air. Can simulate shipborne air defense radar vectoring of AIs.

Span: Accommodates any EW/GCI radar threat beddown or subset thereof; primarily used to simulate Soviet EW/GCI radar network.

Environment: Terrain masking of each radar site is sensitive to penetrator aircraft altitude, radar antenna height, and individual site terrain characteristics (flat, rolling, or hilly).

Force Composition: One penetrating aircraft, one assigned AI, network of EW/GCI radars.

Scope of Conflict: No weapons or pKs in the simulation.

Mission Area: Strategic missions with fixed penetrator flight paths.

Level of Detail of Processes and Entities: A Monte Carlo simulation technique is used to fly a penetrator aircraft in three dimensions over a netted system of ground radar sites. The EW/GCI ground radar detection and tracking capability is simulated using probability distributions and functions to determine when AIs can be assigned and to make penetrator heading, speed, and position estimates to direct an AI to the penetrator thus simulating the manual tracking of a radar operator using a PPI scope.

The NETS model simulates one penetrating aircraft at a time, flying a predetermined path over a group of EW/GCI radar sites. AI combat air patrols are located throughout the geographic area, and AIs of various types are available at these locations to be selected for assignment to intercept the penetrating aircraft. Airborne jammer aircraft may be in the vicinity to degrade the ability of the EW/GCI to detect and establish a radar track on the penetrating aircraft. Communications jamming by penetrator can be simulated.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Dynamic, time-step, event-dependent processing path.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: Number of penetrator flight path lets, number of EW/GCI radar sites, number of radar types, number of AI combat air patrol locations, number of AI type, and number of airborne jammers are limited only by current dimension statements in the FORTRAN code.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None currently planned.

INPUT: Penetrator: speed, altitude, radar cross section, and flight path turnpoints. EW/GCI: radar characteristics and locations, netting, and communication delays. AI: characteristics, locations, and vectoring doctrine. Jammer aircraft: locations and characteristics.

OUTPUT: Probability of AI encounter, AI encounter times, number of AI encounters by sector, penetrator time in EW/GCI radar coverage, and ground radar threat density by type.

HARDWARE AND SOFTWARE:

Computer:	APOLLO.
Storage:	Data base dependent.
Peripherals:	Printer.
Language:	FORTRAN.
Documentation:	Boeing Document No. D500-11432-1 Model 13 August 87 (proprietary).

SECURITY CLASSIFICATION: Unclassified code.

GENERAL DATA:
Date Implemented: 1979.

Data Base: Time required to prepare a data base can vary from several hours to several weeks depending on size.

CPU time per Cycle: Penetrator flight path and data base dependent, typically less than five minutes.

Data Output Analysis: Statistical postprocessors to analyze both AI encounters and EW/GCI radar coverage history.

Frequency of Use: Several times per year.

Users: Boeing Operations Analysis Staff.

Comments: The model can be used for standalone analysis or as a generator of AI encounter events for a larger scale campaign model. The NETS model has been verified and validated.

TITLE: NETSIM - Network Simulation Model

MODEL TYPE: Analysis.

PROPONENT: USA CECOM, Center for C3 Systems, ATTN: AMSEL-RD-C3-AF-1, Ft. Monmouth, NJ 07703.

POINT OF CONTACT: Mr. F. L. Schurgot, Jr., (201) 544-2793. AV 995-2793.

PURPOSE: NETSIM is a research and evaluation tool that can be used to model the Army's postulated tactical circuit switching and packet switching networks. The model was developed to define and analyze candidate routing and flow control algorithms and their adequacy for tactical command and control network applications. This model includes a jamming module that can be used to stress the communication system.

DESCRIPTION:

Domain: Abstract.

Span: Accommodates any abstract area; allows for any arbitrary topology.

Environment: No specific terrain characteristics, distance between nodes in units of length, time, or propagation delay.

Force Composition: BLUE forces.

Scope of Conflict: N/A.

Mission Area: Any mission area using the modeled communication system.

Level of Detail of Processes and Entities: The circuit switch module (CNETSIM) is tailored specifically to model the Mobile Subscriber Equipment system. CNETSIM models up to 16 node central switches (NCS), up to 12 large extension notes, and up to 36 small extension nodes (SEN) or radio acess units. A connectivity of up to 64 channels for NCS/SEN links. Continuous jamming of a particular link or cyclic jamming of a particular link or the most active link at a node can be simulated with various cyclic patterns of on/off times. The packet switch module (PNETSIM) can model various packet switching networks. PNETSIM can model up to 64 nodes, with up to 8 channels or lines per node.

CONSTRUCTION:

Human Participation: Both batch and interactive processing possible. Human participation required to set up various input files for topology, traffic and network characteristics.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Message initiation times are Poisson-distributed for the generation rate at each node, and message lengths are Poisson-distributed for the average length selected.

Sidedness: N/A.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Improvements and/or modifications of CNETSIM should include the development of more robust routing algorithms for the circuit switch and packet switch systems and an Integrated Services Digital Network module. No improvements or modifications are planned at this time.

INPUT: The various characteristics that describe the topology, traffic, and network are required. Inputs that describe the network transport, data link, and network layers as well as the routing and flow control parameters are also required.

OUTPUT: Various descriptive outputs that describe the operation of the network are available, such as information on the messages/packets entered or received, lost messages/packages, queue length, etc. A graphics package that can be used to plot the information during the simulation or after the completion of the simulation is available.

HARDWARE AND SOFTWARE:

Computer:	Currently runs on VAX 11/780 with VMS operating system.
Storage:	N/A.
Peripherals:	Minimum requirements: one graphics printer and one VT125 terminal (VT340 color graphics terminal preferred with mouse).
Language:	Pascal and REGIS graphics.
Documentation:	Final report and various user manuals.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Depends on size of network under study.

CPU time per Cycle: Depends on data base size and size of computer being used. Larger networks and complex situations can take an hour or two of CPU time.

Data Output Analysis: Postprocessor aids in the analysis of the output. Data can be viewed on the terminal, or hard copy is available. Also, graphical outputs are available during an interactive run of the simulation.

Frequency of Use: N/A.

Users: Center for C3 Systems (CECOM), Jet Propulsion Laboratory, University of Nebraska, and USA Signal Center.

Comments: N/A.

TITLE: Network II.5

MODEL TYPE: Analysis.

PROPONENT: CACI Products Co., 3344 N. Torrey Pines Court, La Jolla, CA 92037.

POINT OF CONTACT: Mr. Paul Gorman, (619) 457-9681.

PURPOSE: Network II.5 is not a wargaming model; rather, it is a computer communications network simulation language used as a tool for the system designer. It has possible applications for traffic engineering analysis of C3I distributed networks. It has been purchased by several government agencies, but not CECOM.

DESCRIPTION:

Domain: Abstract--computer communications network.

Span: Abstract--computer communications network.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: C3/C3I.

Level of Detail of Processes and Entities: Computer component blocks, e.g., memory, processor, etc.

CONSTRUCTION:

Human Participation: Required.

Time Processing: Unknown.

Treatment of Randomness: Unknown.

Sidedness: One-sided.

LIMITATIONS: No geography.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Vendor provided.

INPUT: Computer communication nodes and their components.

OUTPUT: Hardware layout graphics, software data flow, device utilization, response times, and data collision conflicts.

HARDWARE AND SOFTWARE:

Computer: Can be hosted on PC, VAX (VMS), and other micro- and minimachines.

Storage: Unknown requirements.

Peripherals: Printer/plotter, VDT.

Language: SIMSCRIPT based.

Documentation: Available from vendor.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: Unknown.

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: As required by application.

Users: Available from vendor.

Comments: None.

TITLE: NMSTPA - Naval Minesweeping Tactical Planning Aid

MODEL TYPE: Analysis.

PROPONENT: USCINCPAC Staff (J55), Box 15, Camp H. M. Smith, HI 96861-5025.

POINT OF CONTACT: Mr. M. L. McCurdy, (808) 477-0797, AV (315) 477-0797.

PURPOSE: NMSTPA is a decision aid used for optimizing naval minesweeping tactics. It assists the user in identifying tactics that provide favorable combinations of attrition and effort. The model uses three MOEs: minefield clearance level, expected minesweeper casualties, and direct effort (in minesweeper-hours). During each model cycle, the user solves one of three planning problems, in which tactics are selected to optimize one MOE subject to constraints on the other two. NMSTPA can be used iteratively to analyze sensitivities to any of its inputs or to trade off two MOEs.

DESCRIPTION:

Domain: Sea.

Span: Local.

Environment: Users consider environment implicitly through the values they assign to model inputs.

Force Composition: Naval mines and minesweepers only. Mines are assumed to be of a single type and setting, with the exception of ship count setting. All minesweepers have identical minesweeping characteristics.

Scope of Conflict: Conventional.

Mission Area: Sea control (naval mine warfare).

Level of Detail of Processes and Entities: Individual minesweepers and mines are not explicitly represented. Minesweepers are continuous rather than discrete entities. Mines are represented by a uniform distribution of mine locations through which minesweepers must pass. Attrition is bilateral: minesweepers clear mines and mines cause minesweeper casualties. Both types of attrition are functions of minesweeper tactics, which also determine the amount of effort expended in sweeping a minefield.

CONSTRUCTION:

Human Participation: Required. NMSTPA requires interactive input of data specifying the problem to be solved. However, once a problem is specified, the program may not be interrupted. When calculations for a problem are complete, NMSTPA prompts the user for data specifying a new problem.

Time Processing: Dynamic, closed form. However, results are not presented as time-dependent.

Treatment of Randomness: Stochastic, direct computation.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Limitations include consideration of single minesweeper and mine types and a limited variety of ship count distribution for mines. Model is also limited to considering sweeping tactics characterized by fixed track spacing and number of runs per track. Other limitations are discussed in the documentation.

PLANNED IMPROVEMENTS/MODIFICATIONS: None.

INPUT: Data describing minefield characteristics, minesweeper characteristics, minesweeper-mine interactions (actuation and damage data), and problem specification (including values of constrained MOEs).

OUTPUT: Screen displays and optional printouts.

HARDWARE AND SOFTWARE:

Computer:	VAX (VAX/VMS) or IBM-compatible PC (MS-DOS).
Storage:	84 Kbytes (VAX).
Peripherals:	Interactive terminal, optional printer.
Language:	ANSI Standard FORTRAN 77; Code substantially conforms with COMINEWARCOM FORTRAN Programming Standard.
Documentation:	USCINCPAC Technical Report, A Cognitive Planning Aid for Naval Minesweeping Operations, 25 April 1987 (Revised April 1988). The software includes on-line help utilities, a tutorial, sample problems, and user notes.

SECURITY CLASSIFICATION: Unclassified. However, COMINEWARCOM considers this software developmental, and the proponent may not honor all requests for release.

GENERAL DATA:

Date Implemented: 1986.

Data Base: 1-2 minutes.

CPU Time per Cycle: Minutes on the VAX; hours on the IBM-compatible PC.

Data Output Analysis: Seconds.

Frequency of Use: 4-5 times per year.

Users: USCINCPAC, USCINCPACFLT, U.S. Naval Coastal Systems Laboratory.

Comments: None.

TITLE: NRMM - NATO Reference Mobility Model

MODEL TYPE: Analysis (primarily a vehicle mobility evaluation model).

PROPONENT: NRMM Technical Management Committee.

POINT OF CONTACT: Mr. Peter Haley, (313) 574-8633; Mr. Donald Randolph, (601) 634-2694.

PURPOSE: NRMM predicts and compares mobility capabilities of candidate ground vehicles for operation in selected areas of the world. It evaluates mobility capabilities in the military ground vehicle acquisition process. NRMM can also be used in course of action assessment, vehicle mix evaluation, and resource planning.

DESCRIPTION:

Domain: On road, off road (forests, farmlands, etc.), across gaps.

Span: Useful from individual vehicle or soldier level up to corps level.

Environment: Off-road area terrain ordinarily mapped in raster, roads and linear features in vector, and urban areas in raster or vector. Each type of terrain is described by factors that significantly influence mobility (e.g., soil strength, slope, surface roughness, vegetation, visibility, obstacles for off-road area terrain). The overall terrain description can be developed from TTADB, ITD, or similar terrain data bases produced by the Defense Mapping Agency. NRMM models weather effects on historical, near-real-time, and forecast bases; can model day and night mobility.

Force Composition: From single vehicles to vehicle mixes. Joint and combined forces, RED and BLUE.

Scope of Conflict: Can adjust vehicle mobility relative to battlefield damage. Rules can be set for restricting or eliminating mobility as a function of conventional, unconventional, or nuclear warfare.

Mission Area: All missions involving U.S. military ground vehicle mobility.

Level of Detail of Processes and Entities: Lowest entity is single vehicle, up to mixes of vehicles. Processes are primarily deterministic based on field-validated relations. Monte Carlo procedures are used in a limited way to interpret terrain and historical weather data. Vehicle mobility on road, off road, and across gaps is modeled primarily in a modular software format that compares pertinent vehicle and driver capabilities with those necessary to satisfy specified terrain, weather, and mission requirements.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, event-step model.

Treatment of Randomness: Mobility treated in deterministic fashion, terrain and historical weather by measured data, then limited Monte Carlo procedures.

Sidedness: Two-sided, symmetric. Single operator or multiple operators.

LIMITATIONS: Limited capability to model mobility in snow; presently does not model engineer-assisted gap crossing, avenues of approach, effects of military-emplaced obstacles, cover and concealment, and formation movement.

PLANNED IMPROVEMENTS AND MODIFICATIONS: In process of removing limitations and enhancing model capabilities.

INPUT: Prescribed digitized data describes vehicles, driver, terrain, weather, and scenario factors that have a significant effect on ground vehicle mobility for specified mission requirements.

OUTPUT: Maps, tabulations, and analyzed data are used to compare mobility capabilities of military ground vehicles and to evaluate mobility capabilities of competing ground vehicles in the military acquisition process.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on VAX computers with VMS operating system.
Storage:	40,000 blocks (35 MB).
Peripherals:	Minimum 1 terminal; can drive printers and graphics terminals.
Language:	FORTRAN 77.
Documentation:	Well-documented programmer's manual.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:
Date Implemented: 1978.

Data Base: For one quad sheet (22 km x 23 km), all terrain factors and ordinary resolution (100m for off-road terrain and 10m for roads and linear features); digitizing requires about one man-month. Vehicle, driver, and historical weather data is preprocessed and requires limited preparation time.

CPU time per Cycle: For one quad and normal terrain data resolution, about 2 minutes.

Data Output Analysis: Postprocessor provides graphical and textual information primarily in comparing the capabilities of available ground vehicles and in evaluating mobility capabilities in the military ground vehicle acquisition process.

Frequency of Use: Varies; used at least several times per year.

Users: U.S. Army Tank-Automotive Command, Material Systems Analysis Agency, Foreign Science Technology Center, participating NATO countries, U.S. Army Engineer Waterways Experiment Station.

Comments: NRMM is managed through a NATO technical management committee that meets every 12-18 months to consider and implement recommended mobility modeling changes in accordance with NATO procedures and priorities.

TITLE: N-SNAP - Non-Strategic Nuclear Attack Planning

MODEL TYPE: Analysis.

PROPONENT: Strategic Systems Analysis Branch (C314), JDSSC, DCA, The Pentagon, Washington, DC 20301-7010.

POINT OF CONTACT: Dr. Dan Wu/Mr. Khoa Nguyen, (202) 695-0025, AV 225-0025.

PURPOSE: N-SNAP is used to allocate a given mixed weapon arsenal with or without range restrictions to given target data at the theater nuclear level.

DESCRIPTION:

Domain: Land and sea.

Span: Accommodates any theater depending on data base.

Environment: Cell based.

Force Composition: Nonstrategic nuclear force.

Scope of Conflict: Nonstrategic.

Mission Area: Nonstrategic warfare.

Level of Detail of Processes and Entities: Aggregated.

CONSTRUCTION:

Human Participation: None.

Time Processing: Static.

Treatment of Randomness: Probabilistic damage assessment.

Sidedness: One-sided.

LIMITATIONS: Model measures prompt blast effects only.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Redesign and recoding.

INPUT: JRAD (336-character) target data base; user-supplied weapon, launcher, and wave-by-wave scenario files.

OUTPUT: Complete summaries of weapon expenditure and target damage assessment.

HARDWARE AND SOFTWARE:

Computer:	VAX.
Storage:	5,000 blocks.
Peripherals:	One printer and one VT 100 terminal.
Language:	FORTRAN 77.
Documentation:	Being developed.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1989.

Data Base: Must have JRAD target data base.

CPU time per Cycle: 15-20 minutes.

Data Output Analysis: Statistical reports.

Frequency of Use: Almost daily.

Users: The Joint Staff/J-8.

Comments: N/A.

TITLE: NUC-STRATEGYST

MODEL TYPE: Analysis.

PROPONENT: Force Structure, Resource, and Assessment Directorate (J-8), The Joint Staff, The Pentagon, Room 1D929, Washington, DC 20318-8000.

POINT OF CONTACT: Peter C. Byrne, (202) 697-7824, AV 227-7824.

PURPOSE: NUC-STRATEGYST is a prototype research and evaluation tool. It is a resource allocation model that positions percentages of defensive resources in response to a posited strategic attack by nuclear weapons. It determines optional BLUE defensive strategies in reaction to RED offensive strikes (or conversely).

DESCRIPTION:
Domain: Land and air.

Span: Global, strategic.

Environment: RED strategies are determined in terms of offensive weapon system allocations. BLUE strategies are defined in terms of defensive resource allocations (ABMs, shelters, space-based platforms, transportation, detection systems, funds, etc.). It employs game theory and linear programming to calculate a solution and differential equations to evaluate the results. The model is fast, responsive, easy to use, and new.

Force Composition: Forces are composed of numbers of offensive, strategic ballistic missiles and defensive ABMs. Model provides for Strategic Defense Initiative defensive measures.

Scope of Conflict: Nuclear, strategic, optimization model.

Mission Area: Addresses defensive resource allocations juxtaposed against a postulated strategic strike.

Level of Detail of Processes and Entities: Numbers of missiles and targets are highly aggregated to compute optimal strategies and to adjudicate combat.

CONSTRUCTION:
Human Participation: Required to define strategies.

Time Processing: Optimal strategy determination is a static process; combat adjudication is dynamic, time-stepped.

Treatment of Randomness: Deterministic optimization model. Combat adjudication, however, is based upon Lanchester attrition coefficients.

Sidedness: Two-sided, asymmetric. Can be executed by a single operator.

LIMITATIONS: This a prototype, highly aggregated, loosely coupled model. It currently requires several operations on two different computer systems to solve a problem.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The game-theoretic, optimization model executes on a VAX, whereas the linear programming problem is solved with a PC-based software package. These two parts are to be integrated into a single code. If the model is to be moved from prototype to production, a preprocessor to automate access of extant target bases and reformat the data into NUC-STRATEGYST inputs also remains to be accomplished. A user interface is required as well.

INPUT: Scenario development requires targets and target complexes. Users organize these target collections into strategies by designating offensive strikes and defensive resource levels. The model also requires Lanchester type attrition coefficients, target acquisition, and damage expectancy probabilities. Target worths are required as well.

OUTPUT: Two-person, zero-sum-game theory is applied to determine an optimal strategy. A mixed strategy is indicated in the event that a saddle-point does not exist. The methodology employs a system of Lanchester-type differential equations to determine the number of incoming strategic weapons that penetrate the defending antiballistic missile systems.

HARDWARE AND SOFTWARE:

Computer:	Currently runs on a VAX computer and on an IBM compatible PC (both are required).
Storage:	Minimum storage required.
Peripherals:	None.
Language:	SIMSCRIPT.
Documentation:	Technical Paper.

SECURITY CLASSIFICATION: Model without data is unclassified.

GENERAL DATA:

Date Implemented: April 1989.

Data Base: N/A.

CPU time per Cycle: Small problems are solved in one to five minutes of CPU time.

Data Output Analysis: Produces hard copy of intermediate and final results.

Frequency of Use: Not applicable to this prototype.

Users: There are no "production" users at this time.

Comments: N/A.

TITLE: NUCWAVE - Nuclear Wave Attack System Model

MODEL TYPE: Analysis.

PROPONENT: Vulnerability Analysis Branch (C312), Joint Data Systems Support Center (JDSSC), The Pentagon, Washington, DC 20301-7010.

POINT OF CONTACT: Denise Maykrantz, (202) 697-7421, AV 227-7421.

PURPOSE: NUCWAVE is used to determine the most advantageous placement of desired ground zeroes (DGZs) for potential targets and inventory of nuclear warheads. Either the total expected target value destroyed is maximized or the number of warheads to attain a damage level per target is minimized.

DESCRIPTION:

Domain: Land.

Span: Force posture studies.

Environment: Targets are a collection of force and other military targets, military and industrial installations, leadership headquarters, and population centers. Force targets are the foci of direct retaliatory threat. Other targets are assigned values of priorities.

Force Composition: Strategic nuclear forces.

Scope of Conflict: Nuclear weapons.

Mission Area: Nuclear weapon allocations given a target data base, a stockpile of nuclear weapons, and attack objectives. The program determines and analyzes potential DGZ placements and selects the most effective.

Level of Detail of Processes and Entities: Individual targets are input, but are aggregated by the model into target complexes and aimpoints. Weapon systems are modeled to the specific load type. Characteristics of targets effect the amount of weapons necessary to achieve the final results.

CONSTRUCTION:

Human Participation: Required for setup, but not required during execution. Several iterations may be run using massaged data developed by other model(s).

Time Processing: Static.

Treatment of Randomness: Deterministic. NUCWAVE is an expected value, computerized nuclear weapon allocation and damage assessment model.

Sidedness: One-sided.

LIMITATIONS: There is a maximum of 3000 targets per complex. However, the number of target complexes is unlimited.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The use of the optimal height of burst needs to be enhanced. The ability to minimize or maximize collateral damage to specific targets is also required.

INPUT: NUCWAVE requires a set of job instructions in NAMELIST format, a target data base in JAD format, and a weapon inventory. In multiwave mode, reduced value data is required.

OUTPUT: Numerous summaries are produced. DGZs are available to SIDAC strike formats. Target damage is available in JAD format.

HARDWARE AND SOFTWARE:

Computer:	IBM 4341 OS/MVS or VMSP/CMS.
Storage:	2000K.
Peripherals:	Standard peripheral equipment: permanent file space. Further I/O devices needed for optional output files.
Language:	FORTRAN.
Documentation:	Limited.

SECURITY CLASSIFICATION: Confidential.

GENERAL DATA:

Date Implemented: 1971.

Data Base: Depends on time needed to develop a JAD and strike data base.

CPU time per Cycle: 1,000 targets per 1 minute CPU time, 10,000 targets per 15 minutes CPU time, and 60,000 targets per 150 minutes CPU time.

These calculations are based on one wave, one weapon type, and potential phase and target data complexed and sorted on latitude and longitude.

Data Output Analysis: Depends on the number of targets and strikes.

Frequency of Use: As necessary for studies.

Users: JDSSC, PA&E, and ISP.

Comments: NUCWAVE is used to create damage response functions for two other models used for PA&E analysis, MIDLAAM and GAINER.

TITLE: NUFAM III - Nuclear Fire Planning and Assessment Model III

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts and Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: LTC R. Barrett, (202) 295-1670, AV 295-1670.

PURPOSE: NUFAM III is a research and evaluation tool used for corps- and theater-level analysis. It supports requirements and capability assessment studies of tactical nuclear forces arrayed in the context of a theater battle.

DESCRIPTION:

Domain: U.S. and opposing land and air forces on a corps-sized frontage. Depth to ±500 km of FLOT.

Span: Corps-level model is routinely run for multiple corps to yield theater-level results.

Environment: User defines unit locations to model based on terrain, posture, and scenario. Terrain features are not represented. Population centers are included for civilian damage and casualty avoidance.

Force Composition: Unit sizes are defined in the data base. Intended for company or battalion representation of units. BLUE and RED units represented.

Scope of Conflict: Nuclear only. Models one or more nuclear pulses occurring within a short period of time (≤ 12 hours). Unit locations remain fixed, although the effect of movement is implicitly represented. No conventional attrition occurs during simulation, but should be reflected in unit strength prior to nuclear use.

Mission Area: Nuclear missions only.

Level of Detail of Processes and Entities: Entities: Company or battalion maneuver unit; artillery and missiles by firing section or launcher, aircraft by sorties from airbases. Defined in data base. Processes: Target acquisition, detailed fire planning, execution of nuclear pulses, assessment of damage to units. Movement is implicitly represented. Damage represented is radiation to personnel and blast to equipment. There is no fallout. Weapons and effects are defined through the data base to allow new weapons to be represented. Fire planning criteria are defined through data base to allow for variations in fire doctrine.

CONSTRUCTION:

Human Participation: Not required outside of preparation of input data.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo. Ten runs are normally required to yield reasonable means.

Sidedness: Two-sided, symmetric in logic, asymmetric in data output values and data-driven doctrine.

LIMITATIONS: No conventional or chemical play, and no explicit movement of units.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Complete revision of model to produce a computationally stochastic, PC-based model is planned for FY 89-90. Preprocessor and postprocessor with graphics will be completed by June 1989.

INPUT: Unit locations and characteristics; nuclear weapons characteristics and effects; parameters defining acquisition, movement, and fire planning logic; size and location of population centers.

OUTPUT: Postprocessor produces 30 reports. Typical results are units acquired and engaged, and defeated weapons selected and fired.

HARDWARE AND SOFTWARE:

Computer:	UNISYS 1180/84.
Storage:	230 K (main); 140 K (extended).
Peripherals:	Calcomp plotter.
Language:	SIMSCRIPT II.5.
Documentation:	CAA-D-86-2, NUFAM III User's Manual. DTIC AD #B113173L.

SECURITY CLASSIFICATION: Unclassified without data.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Data base preparation: one to six months, depending on number of excursions, etc. Preprocessor and postprocessor should reduce by factor of ten.

CPU time per Cycle: Two hours per repetition; 20 hours per excursion.

Data Output Analysis: Can currently produce up to 30 predefined reports. Postprocessor package (June 1989) will allow free-form data base queries and graphic displays.

Frequency of Use: Used to support one to three studies per year.

Users: U.S. Army Concepts Analysis Agency.

Comments: N/A.

TITLE: NUSSE-3
NUSSE-3 (ATM)

MODEL TYPE: Analysis.

PROPONENT: U.S. Army CRDEC.

POINT OF CONTACT: Ron Pennsy, CRDEC, (301) 671-3570 or Dr. Camille D'Annunzio, The BDM Corporation, (703) 848-7471.

PURPOSE: The NUSSE-3 and NUSSE-3 (ATM) models may be used to describe the hazards, both liquid and vapor, from the release of a chemical munition. NUSSE-3, valid for low altitude release, and NUSSE-3 (ATM), valid for release at altitudes up to 20 kilometers, are mathematically formulated based on the transport and diffusion equations. Each model describes the chemical agent from the time of release to its ground impact, and then determines the vapor hazard until all of the agent has evaporated. NUSSE-3 (including the ATM version) may be used to estimate the area of liquid contamination, subsequent vapor contamination, and resulting chemical casualties. NUSSE-3 will handle gaseous, neat, or thickened agents dispensed from multiple munition types. NUSSE-3 methodology consists of describing the chemical cloud immediately after release, following the cloud to ground impact by determining the droplet transport by wind, evaporation, and transport and diffusion of the primary vapor. Ground contamination and lethal footprints are then calculated and the resulting vapor cloud (due to evaporation) is tracked in time.

DESCRIPTION:

Domain: Air and ground.

Span: Local. ATM Version requires actual weather data; Central Europe is available.

Environment: Considers temperature, speed, and wind direction.

Force Composition: N/A.

Scope of Conflict: Chemical warfare. Determines lethal footprints on the ground and subsequent vapor drift, and can be used to estimate chemical casualties.

Mission Area: N/A.

Level of Detail of Processes and Entities: N/A.

CONSTRUCTION:

Human Participation: Required to set up input file, then not permitted. The model is not interruptable.

Time Processing: Dynamic, time-step.

Treatment of Randomness: N/A.

Sidedness: N/A.

LIMITATIONS: Uses a simplistic algorithm for weather effects and does not take wind sheet into play. Also ground deposition grid is limited in size.

PLANNED IMPROVEMENTS): Improvements in the ground deposition grid and the models' graphics capabilities are underway.

INPUT: Includes munition data such as munition type, height of release, and type and quantity of agent. Meteorological information is estimated for NUSSE-3. The ATM version, however, requires actual weather data for the region of interest including wind speed and direction, temperature, pressure, and humidity.

OUTPUT: Includes ground concentration, lethal footprints, map-scaled overlays (these three may be done graphically), dosage/time, and vapor cloud tracking among others.

HARDWARE AND SOFTWARE:

Computer:	Models have been run on UNIVAC, CRAY, VAX-11/780, VAX/8600, and microVAX-II machines. The graphics package requires the availability of DISSPLA.
Storage:	N/A.
Peripherals:	One graphics terminal. Graphics version requires DISSPLA.
Language:	FORTRAN 77.
Documentation:	Published manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: NUSSE-3: May 1987.
NUSSE-3 (ATM): March 1988.

Data Base: N/A.

CPU time per Cycle: Depends on resolution desired; average run is approximately 50-60 CPU minutes on Micro-VAX II.

Data Output Analysis: Large text files that may be printed and graphic files.

Frequency of Use: Frequent when analyzing a chemical threat.

Users: CRDEC, CAA, BRL, BDM Corporation. Has also been given to France, NATO, and Israel.

Comments: Model is designed to give ball park estimates only. The NUSSE-3 models have been used to estimate the size and location of the chemical lethal footprint from a ballistic missile, to determine a keep-out altitude for chemical missiles and the effects of artillery chemical munitions, and to estimate chemical casualties. NUSSE-3 models may also be used to compare the actual ground contamination area with the detectable contamination area.

TITLE: OBSERVE - Laser Observation Program

MODEL TYPE: Analysis and training and education.

PROPONENT: U.S. Army Atmospheric Sciences Laboratory, SLCAS-AE-AE, White Sands Missile Range, NM 88002-5501.

POINT OF CONTACT: Dr. Harry J. Auvermann, (505) 678-4224, AV 258-4224.

PURPOSE: When used as an analysis model, OBSERVE serves as a research and evaluation tool that deals with combat development. It also deals with competing strategies of deployment and countermeasures to battlefield lasers. The model produces files containing data from which pictures of the appearance of a laser beam traversing a battlefield atmosphere can be made. The laser can be pulsed or continuous wave, scanning or pointing. The sensor can be staring, serial scan, or parallel scan. The picture represents the sensor display. The output can be transformed into printer images or video tapes. Video tapes can be used to gather statistical information on detectability of laser beams from a number of operators for selected scenarios. For training and education purposes, video tapes produced from model data can be used to train sensor operators in laser detection. The model will improve troop performance by developing the skills of individuals.

DESCRIPTION:

Domain: Land.

Span: Regimental battlefield.

Environment: Flat terrain, variable visibility, variable climate, simulated background, six degrees of freedom for laser, and sensor location and orientation.

Force Composition: Front line units.

Scope of Conflict: Deployment, RED or BLUE, of laser rangefinders, designators, and weapons. Deployment, RED or BLUE, television, image intensifiers, and thermal viewers.

Mission Area: Suppression of battlefield use of lasers.

Level of Detail of Processes and Entities: The model calculates the intensity of laser radiation scattered into the sensor by the device port and atmospheric particulates. The calculation is done for an array of picture elements that represents the sensor display. The intensity calculated this way is added to the background array of intensities that have been supplied by the analyst. The background array is derived, typically, by digitizing a photograph or infrared image of a representative scene.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: Uniform battlefield conditions.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Upgrade to EOSAEL format.

INPUT: Weather, sensor, and laser data from ASCII files and background data from binary files.

OUTPUT: A series of data files on magnetic tape. Each file typically represents one frame of the sensor display.

HARDWARE AND SOFTWARE:

Computer (OS):	VAX 11/780 VMS.
Storage:	200,000 bytes.
Peripherals:	Line printer and magnetic tape drive.
Language:	FORTRAN.
Documentation:	Internal, users guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Minimal run time, two days for background.

CPU time per Cycle: One hour per 30 frames. A typical sensor produces 30 frames per second of real time.

Data Output Analysis: Once a video digital-to-analog converter has been united with a tape reader, a video tape can be produced in a few minutes.

Frequency of Use: Inactive.

Users: ASL.

Comments: Some of the branches of OBSERVE have not been completely debugged.

TITLE: OPSURV - Operational Survivability Model

MODEL TYPE: Analysis.

PROPONENT: Defense Nuclear Agency, Washington, DC 20305-1000, The BDM Corporation, 7915 Jones Branch Drive, McLean, VA 22102.

POINT OF CONTACT: William T. Cooper, (703) 848-7510 or Robert H. Sharify, (703) 848-6025.

PURPOSE: OPSURV is used to assess risk and measures to reduce risk for units under threat of nuclear, chemical, and conventional attack. Its applications include planning, training, and analysis of doctrines and issues related to survivability.

DESCRIPTION:
Domain: Land.

Span: Division/brigade area of influence.

Environment: Digitized terrain in 100m x 100m blocks that enable elevation and relative density.

Force Composition: Battalion and company components.

Scope of Conflict: Acquisition threat, chemical, nuclear, and conventional attack survivability.

Mission Area: All land-based division/brigade deployment with 200 km of the FLOT.

Level of Detail of Processes and Entities: All detection and targeting results based on individual company activity, location, composition, and lucrativeness factors can be displayed for battalion and company.

CONSTRUCTION:
Human Participation: No user interruption is needed; model is data-driven.

Time Processing: Static. Each run simulates a "picture" taken of the force deployment, performing detection analysis at any given instant.

Treatment of Randomness: Deterministic procedures for detection and verification. Stochastic, Monte Carlo procedures for targeting and attack results.

Sidedness: Two-sided, RED side (sensor deployment) nonreactive.

LIMITATIONS: The geographical area for gaming is restricted to stored digitized terrain data (currently 200 km in the vicinity of Fulda, West Germany).

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Data on division, threat factors, and other parameters.

OUTPUT: Unit deployments on terrain are shown on a color monitor with symbols of units at high risk highlighted. The black and white monitor depicts unit data, lists of units at risk, and other output. Printouts of selected output can also be obtained.

HARDWARE AND SOFTWARE:

Computer:	APPLE II Plus.
Storage:	10 MB.
Peripherals:	CORVUS hard disk, black and white monitor, color monitor, printer, joystick, videodisc player, PGS graphics system (SYMTEC), and VMI package.
Language:	Pascal.
Documentation:	Detailed user's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Two man-weeks.

CPU time per Cycle: Four hours.

Data Output Analysis: Raw data and graphics format.

Frequency of Use: Undetermined.

Users: DNA/U.S. Army Combined Arms Center and BDM.

Comments: None.

TITLE: OPUS1 - Optimal Preferential Utility and Strategies Program, Version 1

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SASM), The Pentagon, Room 1D431, Washington, DC 20330.

POINT OF CONTACT: Capt Steve Misra, AFCSA/SASM, (202) 697-9702, AV 227-9702.

PURPOSE: OPUS1 is a computer program that evaluates effectiveness of a defensive system operating with preferential strategies.

DESCRIPTION:

Domain: Air and exoatmospheric.

Span: Global.

Environment: N/A.

Force Composition: BLUE on RED or RED on BLUE.

Scope of Conflict: Nuclear.

Mission Area: Strategic nuclear.

Level of Detail of Processes and Entities: Each offensive weapon (RV) has some probability, pK, of destroying the target at which it is aimed, and each interceptor has a probability, pI, of intercepting an RV to which it is committed. Both the offense and the defense must allocate their weapons for optimal effectiveness, but each is ignorant of its opponent's allocation. These allocations form a pair of preferential strategies, and the theory of two-person, zero-sum games provides a formulation by which each side can choose its best strategy.

CONSTRUCTION:

Human Participation: Required for initial input parameters and for refinements for each iteration.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Uses Monte Carlo techniques.

Sidedness: Two-sided.

LIMITATIONS: Limitations on number of offensive nuclear bursts at each target and number of interceptors/RVs. Running model is a time-consuming process.

PLANNED IMPROVEMENTS AND MODIFICATIONS: RAND Corporation planning a newer version of OPUS.

INPUT: Probability of detection, probability of intercept, offense booster reliability, defense unit availability, etc.

OUTPUT: Provides an optimal offense and defense strategy given the initial input parameters.

HARDWARE AND SOFTWARE:

Computer: VAX 11/780 computer.
Storage: N/A.
Peripherals: Screen and printed output.
Language: FORTRAN.
Documentation: OPUS1 User Manual.

SECURITY CLASSIFICATION: Unclassified source code.

GENERAL DATA:

Date Implemented: 1981.

Data Base: One week.

CPU time per Cycle: Six seconds on the STC 4080.

Data Output Analysis: One hour per iteration.

Frequency of Use: As needed.

Users: AFCSA/SASM and RAND.

Comments: None.

TITLE: ORDAM - Obstacle Removal Delay Assessment Model

MODEL TYPE: Analysis.

PROPONENT: The BDM Corporation, 7915 Jones Branch Drive, McLean, VA 22102.

POINT OF CONTACT: Karen A. Stark, (703) 848-6258 or John Chalecky, (703) 848-6374.

PURPOSE: ORDAM is used to evaluate the contribution made by area denial mines used in conjunction with runway cratering munitions to airfield duration of closure.

DESCRIPTION:

Domain: Land.

Span: Single airbase level.

Environment: Cratered and uncratered areas on airfield launch and recovery surfaces, and grassy areas to either side of the surfaces.

Force Composition: Component.

Scope of Conflict: Considers conventional runway cratering munitions and area denial mines.

Mission Area: Airfield attack.

Level of Detail of Processes and Entities: Individual vehicles and personnel are modeled. Processes modeled include tank dozers sweeping the minefield area, dismounted personnel employing small arms fire to detonate and destroy mines, and dismounted personnel using set charges to destroy mines in place. Movement and attrition are explicitly considered.

CONSTRUCTION:

Human Participation: Not permitted. Clearing methods to be employed are chosen in input preparation phase.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Minefield dimensions and densities are determined stochastically based on delivery system errors and mine dispersion parameters. Vehicle and personnel attrition is treated in a Monte Carlo fashion. In addition, mines with a self-destruction mechanism are explicitly modeled with a user-defined random self-destruct distribution.

Sidedness: One-sided.

LIMITATIONS: Does not consider sensor-fuzed, wide area mines.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Logic to handle target-activated fuzing, such as seismic, acoustic sensing.

INPUT: Requirements include attack system parameters such as size of attack, cratering munition and mine characteristics, clearing methods to be employed, their rates of operations, and their vulnerability to mine detonations.

OUTPUT: Produces distributions on the amount of time required to counter the various portions of the minefield.

HARDWARE AND SOFTWARE:

Computer:	Runs on DEC VAX series and IBM PCs and compatibles.
Storage:	Approximately 150 KB.
Peripherals:	No special requirements.
Language:	FORTRAN.
Documentation:	Limited.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: January 1985.

Data Base: Approximately one man-week.

CPU time per Cycle: Depends upon size of attack and clearing resources available. A "typical" case requires approximately five minutes on a DEC MICROVAX.

Data Output Analysis: Raw data and summary statistics are provided for ease of interpretation.

Frequency of Use: As required.

Users: U.S. Air Force Armaments Division, Commercial Concerns.

Comments: Normally used in conjunction with a number of BDM'S family of models.

TITLE: OSADS - Optical Signature Acquisition and Detection Model

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. Bill McQuay, (513) 255-2164.

PURPOSE: OSADS calculates air vehicle detectability for man-in-the-loop EO or visual sensor systems. The model is capable of simulating the optical environment and determining the perceived optical characteristics (optical signatures) of the target. These optical signatures, along with the environmental and sensor performance parameters, are used to determine target detectability.

DESCRIPTION:

Domain: Land, sea, and air.

Span: Individual.

Environment: The model can simulate a clear day only. The direct solar illumination, skylight illumination, and upwelling illumination are represented. The solar illumination is described using the solar constant at the top of the atmosphere attenuated by the "optical thickness" of the atmosphere to the altitude in question.

Force Composition: One target vehicle and one observer.

Scope of Conflict: No weapons are modeled.

Mission Area: Optical region.

Level of Detail of Processes and Entities: A single target vehicle is modeled. The model produces a probability of detection and an apparent contrast map. The contrast map levels are defined as follows: negative contrast, identified by the numbers 0, 1, 2, 3, or 4, represents a target element that is darker than the background; positive contrast, identified by the numbers 5, 6, 7, 8, or 9, represents a target element that is brighter than the background.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Static.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Target track or flight profile data set, input parameter file and the target shape description data set.

OUTPUT: The output data file produced contains a list of the input parameters. It also identifies the total number of nodes in the target shape description. In addition, the user can choose a plotting option that creates a graphical depiction of the target.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	470,016 bytes.
Peripherals:	No special requirements.
Language:	FORTRAN IV.
Documentation:	User's guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: N/A.

CPU time per Cycle: 93 seconds.

Data Output Analysis: Manual analysis of tabular results.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: OSAMM - Optimum Supply and Maintenance Model

MODEL TYPE: Analysis.

PROPONENT: HQ, CECOM, ATTN: AMSEL-PL-SA, Fort Monmouth, NJ 07703-5004.

POINT OF CONTACT: Mr. Owen Robatino, (201) 532-3646, AV 992-3646.

PURPOSE: The OSAMM can be used as a research and evaluation tool for logistic support analysis (LSA). It performs level-of-repair analysis on new and existing equipment, which includes weapon systems and support equipment. The OSAMM can deal with a system's development by determining the impact of system design on logistics support.

It should be noted that the OSAMM can be used during any phase of a system's life. It can be used to determine the maintenance concept of any equipment prior to fielding or to reconsider the maintenance concept of an equipment after fielding. It determines the most cost-effective maintenance concept and initial spares placement for an equipment, subject to an availability requirement.

DESCRIPTION:

Domain: Land.

Span: Global.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Entities include line replaceable units (LRUs) and shop replaceable units (SRUs) within an equipment, test equipments and repairmen used to repair the equipment, and maintenance and supply echelons for the equipment. Processes include repair of end item, LRUs, and SRUs and supply of LRUs, SRUs, and piece parts.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Static.

Treatment of Randomness: Deterministic; generates values as a function of expected values.

Sidedness: N/A.

LIMITATIONS: OSAMM is not a wargaming or simulation model.

PLANNED IMPROVEMENTS AND MODIFICATIONS: To be determined by the U.S. Army Materiel Command Materiel Readiness Support Activity.

INPUT: LRU/SRU breakdown, logistic structure, reliability and maintainability data, inventory cost parameters, order-ship times, turnaround times, and operational availability target.

OUTPUT: Repair-level decisions, spares requirements, test equipment and repairmen requirements, costs, and operational availability.

HARDWARE AND SOFTWARE:

Computer:	Control Data Corporation (CDC) Network Operating System (NOS).
Storage:	Unknown.
Peripherals:	Terminal and line printer.
Language:	FORTRAN.
Documentation:	OSAMM Release 2.0 User's Guide, DTIC ADA 187675 and OSAMM technical documentation.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: Original release: 1983.
Release 2.0: 1987.

Data Base: Depends on the user's knowledge of LSA, OSAMM, and the equipment being modeled.

CPU time per Cycle: Depends on the complexity of the equipment being modeled.

Data Output Analysis: Depends on the user's knowledge of OSAMM.

Frequency of Use: Varies by command, but is used at least several times per year by those listed below.

Users: CECOM and AMCCOM.

Comments: OSAMM uses algorithms of the Selected Essential-Item Stockage for Availability Method (SESAME) model, which is the standard Army sparing to availability model.

TITLE: P001 - Anti-Aircraft Artillery Simulation Computer Program

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SAGF), The Pentagon, Washington, DC 20330-5420.

POINT OF CONTACT: Maj Dave Yonika, (202) 694-4247, AV 224-4247.

PURPOSE: P001 computes the single-shot probability of kill of a target aircraft flying through AAA. The results are used in weapons systems effectiveness studies.

DESCRIPTION:
Domain: Air and ground.

Span: Individual aircraft against individual AAA site.

Environment: Terrain relief.

Force Composition: Individual elements.

Scope of Conflict: Conventional.

Mission Area: Tactical.

Level of Detail of Processes and Entities: Entity: Aircraft, AAA site. Processes: Movement of aircraft.

CONSTRUCTION:
Human Participation: Not permitted.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: One-on-one.

PLANNED IMPROVEMENTS AND MODIFICATIONS None.

INPUT: Gun type, firing constraints, and site array.

OUTPUT: Computer printout summarizing results.

HARDWARE AND SOFTWARE:

Computer:	Honeywell (MULTICS), PC-Compatible (MS-DOS), IBM 3081 (MVS).
Storage:	N/A.
Peripherals:	N/A.
Language:	FORTRAN
Documentation:	Available from SURVIAC (Model Repository), Wright-Patterson AFB.

SECURITY CLASSIFICATION: Unclassified (without data).

GENERAL DATA:

Date Implemented: N/A.

Data Base: Varies.

CPU time per Cycle: 5 minutes.

Data Output Analysis: N/A.

Frequency of Use: 60 times per year.

Users: AF/SAGF, AD/EN, AFOTEC/OA, Naval Weapons Center, others.

Comments: None.

TITLE: PACES - Performance Analysis for Communications-Electronics Systems

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Electronic Proving Grounds, Attn: [STEEP-(T-E)], Fort Huachuca, AZ 85613-7110.

POINT OF CONTACT: Mr. Steven C. Cooper, (602) 538-4953, AV 879-4953.

PURPOSE: An operational support tool or decision aid, PACES is used to assist in conducting compatibility and vulnerability analyses of communications and electronic equipment and systems in tactical deployments. The output is used to determine whether systems are suitable for deployment.

DESCRIPTION:

Domain: Land and air; limited space and naval.

Span: Accommodates any theater depending on data base. Can model individual equipment to full corps and above deployments.

Environment: Detailed RF phenomenology model. Models the effect of terrain and ground constraints in either an area-prediction or a point-to-point mode. Can use DMA digitized terrain data as input. Effects of time of day, month, and climatology considered for various propagation models.

Force Composition: Joint and combined: BLUE, GREY, RED.

Scope of Conflict: Conventional warfare.

Mission Area: All phases of conventional warfare.

Level of Detail of Processes and Entities: Uses deployment data concerning the location, terrain, and required linking of communications-electronics (C-E) equipment contained in a tactical force to calculate the communicability, compatibility, and vulnerability of the C-E systems. Samples a required number of links and initially determines the probability of communication (compatibility) over a link without interference. This probability is based on equipment, technical performance, characteristics, and propagation losses. Then computes the propagation loss for each possible interferer and computes a desired versus interferer signal ratio. Next is computation of the probability of correct information transfer (compatibility) using previously measured performance data (scoring) for each particular kind of C-E equipment. The effects of jamming (vulnerability) on each link are similarly calculated by substituting the jammer as the interferer. ESM functions of intercept and DF are also modeled. For DF, the model can produce both a numerical probability of DF and an associated CEP value.

CONSTRUCTION:

Human Participation: Not required and not permitted.

Time Processing: Static.

Treatment of Randomness: Can be run in either deterministic or probabilistic mode. Monte Carlo options are available for estimations of propagation variables from the mean.

Sidedness: Not applicable.

LIMITATIONS: Does not model specific effects of foliage or urbanization.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Propagation modules are under study for enhancement and computer graphical development for file updates, data validation, and model output presentations.

INPUT: Tactical deployment data, equipment technical performance characteristics, propagation path loss parameters, message traffic data.

OUTPUT: Printout and disk files of probability of C-E equipment and systems communicability, compatibility, and vulnerability performance in their intended tactical operational environment. Output files can be postprocessed using standard statistical packages.

HARDWARE AND SOFTWARE:

Computer:	CDC CYBER 180 Model 830.
Storage:	Variable; requirements can be adjusted.
Peripherals:	Optimum number of disks and tape drives varies; variable mass storage requirements in size of data files determine requirements.
Language:	SLACS 5 (an extended FORTRAN 77).
Documentation:	Extensively documented with four manuals published.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1970.

Data Base: Preparation of complete new corps-size deployment with appropriate RED forces requires one year. Analysis requiring data modification for specific test system requires one to two months, depending on system.

CPU time per Cycle: Depends on deployment size and number of equipment to be evaluated. Corps-size deployment can take 100 hours of CPU time.

Data Output Analysis: Hard-copy printouts and disk files suitable for postprocessing.

Frequency of Use: Varies; four to six analyses performed per year.

Users: Model is resident at U.S. Army Electronic Proving Grounds. EMC/EMV analyses have been performed for a variety of government agencies.

Comments: Model is not machine dependent but takes advantage of the CDC CYBER 60-bit word for optimizations of data storage and access and would require modification for other environments.

TITLE: PANTHER: Low Intensity Conflict (LIC) Simulation

MODEL TYPE: Training and education.

PROPONENT: Combined Arms Training Activity (CATA)/TRADOC Analysis Command, Fort Leavenworth (TRAC-FLVN).

POINT OF CONTACT: CW2 David D. Holmes, (913) 684-5426, AV 552-5426.

PURPOSE: PANTHER is a command post exercise driver used to train brigade and battalion command and staff elements conducting operations in a LIC environment.

DESCRIPTION:

Domain: Air, land, and sea with emphasis on land.

Span: Regional or local area.

Environment: Uses standard topographic maps (1:6250 suggested scale); some game functions sensitive to night and day, weather, and terrain features.

Force Composition: Primarily designed to simulate a brigade force, but data structures are flexible enough to simulate joint forces, paramilitary and police forces, and guerilla forces.

Scope of Conflict: Uses conventional and subconventional weapons, and depicts operations from terrorist attacks through company-on-company operations.

Mission Area: Uses any and all conventional weapon types to combat insurgents in operational area. Primary goal of simulation is to control and protect population in operational area.

Level of Detail of Processes and Entities: The lowest level of detail that may be directly represented is a squad, individual equipment/weapon system, individual watercraft, or individual air frame. All squad records are capable of defining from 1 to 20 personnel and from 1 to 10 equipment systems (exclusive of individual weapons that are associated with individuals). Casualties and equipment damages are applied to individual persons or systems defined within the squad. It is recommended that a squad record be used to define an infantry squad, headquarters element, a single major equipment system, and crew (i.e., one truck and crew, one helicopter and crew, or one howitzer and crew).

CONSTRUCTION:

Human Participation: Required for decisions and processes. Some routine decisions and processes are automatic and not interruptable (e.g., hourly consumption calculation, nonbattle calculations, and maintenance failures).

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Basically a three-sided game with the RED and BLUE forces fighting each other, with both competing for the loyalty of the GREY force (civilian population). The RED and BLUE forces may be symmetric or asymmetric (scenario dependent). The GREY force is asymmetric and nonreactive.

LIMITATIONS: No special representation in computer model. All terrain, location, line-of-sight, and detection functions/features must be played on the map board with the markers/counters and human interpretation of terrain effects.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Basic model is under development.

INPUT: Weapons, equipment systems, and ammunition characteristics are defined in library files that must only be input once (although they are capable of being changed). Troop unit definitions and population center (GREY force) definitions must be entered for each scenario to be played.

OUTPUT: Includes processed data describing current status of units, actions affecting units, results of actions by units, as well as standard reports showing library definitions.

HARDWARE AND SOFTWARE:

Computer:	One or more IBM compatible personal computers; MS DOS 2.0 or greater operating system.
Storage:	512K internal memory.
Peripherals:	At least 10 MB hard disk (20 or 40 preferred), color graphics adapter, one or more floppy disk drives, and Epson compatible printer.
Language:	Turbo Pascal Version 5.5.
Documentation:	Future contractor deliverable.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Depends on scenario complexity. Probable range of one to five days.

CPU time per Cycle: Interdeterminate.

Data Output Analysis: No specific analysis required. Data output is supplied to users in report format. No further analysis requirements have been defined.

Frequency of Use: As required to drive appropriate CPX training simulation.

Users: USSOUTHCOM, USARSA, U.S. light infantry divisions, friendly Latin American militaries, and U.S. and friendly foreign military schools.

Comments: Model described herein is intended as a baseline prototype for an LIC simulator. Significant enhancements to basic structure are anticipated.

TITLE: PARACOMPT - Parametric Analysis of Respiratory Agents Considering Operations, Motivations, Protection, and Time

MODEL TYPE: Analysis.

PROPONENT: CRDEC, Studies & Analysis Office, Aberdeen Proving Ground, MD 21010-5423.

POINT OF CONTACT: Mr. Richard zum Brunnen, (301) 671-3570, AV 584-3570.

PURPOSE: PARACOMPT simulates a chemical battlefield warfare scenario. It performs a comprehensive assessment and evaluation of target area coverage and personnel casualty estimates. It was initially designed to perform evaluation studies of the effectiveness of developmental and standardized chemical munition systems. It was later designed to examine combat operations of troops taking MOPP protective action as a function of time.

DESCRIPTION:

Domain: Land: flat, open terrain.

Span: Targets can be characterized from platoon to battalion size.

Environment: Static battlefield with steady-state meteorological conditions.

Force Composition: BLUE or RED unit characterization.

Scope of Conflict: Chemical warfare.

Mission Area: Chemical combat missions.

Level of Detail of Processes and Entities: This is a high resolution assessment methodology. Highly detailed characterization of chemical cloud patterns and target units can be evaluated in fine increments of time and space.

CONSTRUCTION:

Human Participation: Not permitted after initial inputs have been set up and program executes.

Time Processing: Snapshots are taken of battlefield situation at specific time periods or intervals.

Treatment of Randomness: Stochastic, Monte Carlo simulation of munitions being delivered onto a target area. The program determines statistics on mean and standard deviation for casualties and area coverage.

Sidedness: One-sided simulation of a battlefield chemical warfare scenario.

LIMITATIONS: User needs access to a mainframe with considerable memory available.

PLANNED IMPROVEMENTS AND MODIFICATIONS: This model has recently undergone an extensive redesign and code improvement effort. The new code is currently

being retested and verified for accuracy. The input requirements for setting up and stacking the many run cases have undergone an extensive modification and simplification effort. Even though the use of this model is still "batch processing," simplifying the input has made it much more usable.

INPUT: The program operates in a "batch" predeveloped input data set mode. The main inputs are: number of replications, delivery errors, aim points, number of rounds fired, single munition chemical cloud grid, target sizes and location, and personnel agent dose-response parameters for casualty estimation.

OUTPUT: The main outputs are calculated casualties and area coverage levels for each target as well as a composite grid of dosage and deposition values that results from overlapping of multiple rounds.

HARDWARE AND SOFTWARE:

Computer:	Currently runs on the UNIVAC 1100/60 system.
Storage:	Approximately 3500 lines of code.
Peripherals:	Minimum requirement: one printer.
Language:	ASCII Standard FORTRAN 77.
Documentation:	Technical report is available on the current program. Another technical report and user's guide on the "new and improved" program version will soon be available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: Early 1960s.

Data Base: Setting up the target array is the most time-consuming effort. Setup time varies from minutes to a half hour.

CPU time per Cycle: A typical UNIVAC 1100/60 run takes from 45-90 seconds of core time. CPU time depends upon input data base of conditions for simulation of desired scenario. Execution time increases directly as the setup and simulation of the battlefield scenario increase in complexity.

Data Output Analysis: No postprocessor is available for analysis of output results.

Frequency of Use: Regular usage within CRDEC varies from daily to monthly.

Users: CRDEC, NRDEC, AMSAA, Air Force, Honeywell, BDM.

Comments: PARACOMPT has been used with a number of different cloud generators in the past, but has most recently been used with the NUSSE type of methodology since NUSSE3 can generally characterize most types of chemical agents. PARACOMPT has a unique feature that enables it to be used to evaluate variable height of functioning chemical munitions.

TITLE: PASTE - Penetration Assessment of Terminal Engagements

MODEL TYPE: Analysis.

PROPONENT: Boeing Military Airplane Company, ATTN: D. D. Genzlinger, P.O. Box 3707, Seattle, WA 98124.

U.S. Army Missile Command, ATTN: AMSMI-OR-SA (Mr. Wayne M. Leonard), Redstone Arsenal, AL 35810-3216.

POINT OF CONTACT: Boeing: Darrell D. Genzlinger, (206) 655-4816.

U.S. Army Missile Command: Wayne M. Leonard, (205) 876-0500, AV 746-0500.

PURPOSE: The PASTE model performs an expected value analysis for calculating the dynamic status of a penetrator's survivability during a terminal engagement between a Soviet SAM and an attacking penetrator. The simulation aids in evaluating the effectiveness of penetrator characteristics, such as radar cross section, speed, maneuverability, and flight altitude. It also evaluates the effectiveness of the missile defense system during a terminal engagement. PASTE is a one-on-one engagement simulation that incorporates a shoot-look-shoot firing doctrine by the defense. In addition, however, it can process many one-on-one engagement games during a single computer run. Although the program was originally written to simulate, in high-level detail, the engagement game of a SAM defense site engaging the SRAM, it can be used for any penetrator flying a predefined path.

DESCRIPTION:

Domain: Can be a combination of land, sea, and air.

Span: Local or individual.

Environment: Terrain relief, terrain cultural features, and sea states.

Force Composition: N/A.

Scope of Conflict: Conventional, with some nuclear effects.

Mission Area: Indirect artillery (fire support and air defense).

Level of Detail of Processes and Entities: Entity: Individual aircraft or missile. Processes: Attrition and movement of entities.

CONSTRUCTION:

Human Participation: Not permitted during execution.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Hybrid: stochastic (direct computation, but SAM missile flyout trajectory can be Monte Carlo) and deterministic (generates a value as a function of an expected value).

Sidedness: One-sided with no further subclassification.

LIMITATIONS: Only one penetrator and 70 SAM sites; a limited number of missiles per SAM site, components of a penetrator, and glint points.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Currently none.

INPUT: Soviet SAM characteristics, such as sites and limitations to their radars and missiles, as well as input of penetrator itself, which includes RCS, blast kill radius, sure safe radius, and a trajectory.

OUTPUT: Detailed penetrator data, computed miss distance, table lookup for kill analysis, and fragmentation kill analysis available.

HARDWARE AND SOFTWARE:

Computer:	DEC-VAX 11/780 and 785; APOLLO (all models); and IBM-360, 370, and 332.
Storage:	5000-8000 lines of code, 2000-3000 lines of data.
Peripherals:	Printer.
Language:	FORTRAN 77.
Documentation:	Boeing document D448-10900.

SECURITY CLASSIFICATION: Model without data is secret.

GENERAL DATA:

Date Implemented: Approximately 1967 - 1968.

Data Base: One week to two months required to prepare data base.

CPU time per Cycle: Depends on computer type, penetrator's speed, RCS, altitude, type of SAM system, and number of parametric cases per run concurrently if ECM techniques are used and end game analysis is performed. If user is printing miss distance output with 12 parametric offset fly by cases while flying a 1.5 Mach, 1 square meter RCS at 4000 feet altitude penetrator against an SA-12 (Gladiator) missile with no ECM, it will take 108 CPU minutes on a VAX 11/780 computer.

Data Output Analysis: Depends on type of analysis and number of parametric cases for a single cycle.

Frequency of Use: Used continually.

Users: Boeing, AFCSA, and U.S. Army Missile Command Systems Analysis Office.

Comments: Other models used in conjunction with PASTE: Terrain Model, FATE RCS, and TRAJGN-trajectory generator model.

TITLE: PATROL

MODEL TYPE: Analysis.

PROPONENT: U.S. Coast Guard R&D Center, Marine Systems Branch, Avery Point, Groton, CT 06340-6090.

POINT OF CONTACT: Clark Pritchett, (203) 441-2653, FTS 642-2653.

PURPOSE: PATROL is designed to compare the capabilities of alternative vessels in law enforcement patrols that are being considered for acquisition. PATROL is currently a research and evaluation tool dealing with force capability and requirements. It could also be used as operation support tool.

DESCRIPTION:

Domain: Coastal and ocean.

Span: Individual vessel.

Environment: Sea state distribution and limiting sea states.

Force Composition: One Coast Guard cutter plays against a mix of many potential violators.

Scope of Conflict: Limited to patrolling functions in which the adversary does not shoot back.

Mission Area: Coast Guard Law Enforcement patrols. With modifications, it could be used for naval operations such as Marketime.

Level of Detail of Processes and Entities: A patrol is broken up into phases (e.g., search intercept), which are separated by events (e.g., detection). Input information is organized into four areas: vessel, traffic, area, and operations. This information is processed to produce times in each phase of the patrol and a probability transition matrix. A Markov model is solved to give long-term times in each phase of the patrol, number of events (e.g., seizures), and logistics information such as fuel consumed and miles traveled. Various MOEs that relate to the goal of the patrol are computed.

CONSTRUCTION:

Human Participation: Required for gathering input information.

Time Processing: Automatically by program.

Treatment of Randomness: Distributions of traffic and environment are input to produce average values used by Markov model, which is deterministic.

Sidedness: Can be played either way. For example, single vessel characteristics or traffic distribution can be changed.

LIMITATIONS: The traffic does not shoot back. There is no engagement phase in the model. C3I is accounted for in the inputs, not dynamically.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Graphics for inputs and outputs are planned for the future.

INPUT: Vessel operating and engineering characteristics (speed in a seaway, fuel consumption curve, tankage, etc.) describe the vessel. Traffic is broken into categories and described by arrival rates. Policy, strategy, and tactics are explicitly accommodated.

OUTPUT: Compressed into three pages that describe patrolling vessel effort, performance, and logistics. Detailed information is also available.

HARDWARE AND SOFTWARE:

Computer:	MicroVAX with VMS.
Storage:	Very small.
Peripherals:	1 printer and VT-100 terminal.
Language:	FORTRAN.
Documentation:	3-volume set.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Not yet done.

CPU time per Cycle: Runs instantly.

Data Output Analysis: Embedded in program.

Frequency of Use: Used in initial stages of procurement.

Users: USCG Office of R&D.

Comments: PATROL is an easy-to-understand yet comprehensive model of a single vessel on patrol. The effect of each one upon mission performance can be more clearly understood when the inputs are separated into different categories. Policy, strategy, and tactics are expressed in the model through items such as the refueling level, boarding criteria, and search pattern.

TITLE: PAWS - Parametric Assessment of Weapons Systems

MODEL TYPE: Analysis.

PROPONENT: The BDM Corporation, 7915 Jones Branch Dr., McLean, VA 22102-3396.

POINT OF CONTACT: Earl Williamson, (703) 848-6111.

PURPOSE: PAWS provides a rapid capability to determine how major weapon system parameters influence the expected outcome of a many-on-many direct fire engagement within a detailed tactical and terrain context. It can be used by analytic personnel with only cursory training on an IBM PC-type computer. It is primarily oriented toward weapon system effectiveness, although terrain and tactics are treated.

DESCRIPTION:

Domain: Close combat.

Span: A single engagement between combined arms maneuver units.

Environment: Terrain treated in 500-meter blocks with several categories of forestation, terrain cover, and canalization. Time in increments chosen by the user. Terrain area is 6 km x 3 km.

Force Composition: Combined arms team with artillery fire support.

Scope of Conflict: All conventional direct fire weapons, several categories of artillery, mines, and barriers are played.

Mission Area: Close combat.

Level of Detail of Processes and Entities: The simulation plays a defending force that can be separated into several spatial groupings. As the assaulting force closes on the defending force, the ability of each weapon system to cause attrition changes as the ranges change and the aspect angle of the firer target line changes. Allocation of fire is constantly re-evaluated on the basis of a dynamically changing target value and the opportunities presented by targets. A system (vehicle or fire team) can have several weapons. Each element (part of the attacking force) has several systems.

CONSTRUCTION:

Human Participation: The analyst loads the conditions and objectives of each force, and then executes a trial of the engagement without further input.

Time Processing: Time-step in increments where the minimum time step is the cycle rate of the weapons.

Treatment of Randomness: Completely deterministic.

Sidedness: Two-sided, asymmetric.

LIMITATIONS: Current version does not integrate long time-of-flight weapons survival (i.e., TOW, Dragon) over the time-of-flight interval.

PLANNED IMPROVEMENTS AND MODIFICATIONS: To integrate survival of long time-of-flight weapons over time-of-flight interval.

INPUT: The probability of hit of each weapon by range and target exposure, the probability of kill of each weapon by aspect angle and exposure, the terrain, the firing doctrine for RED and BLUE, and the tactical objectives of RED and BLUE.

OUTPUT: Killer-victim scoreboards for each weapon versus target combination and the outcome of the engagement. Suppressions and the strength of each element of the force are provided at each time step.

HARDWARE AND SOFTWARE:

Computer:	Any IBM PC compatible with 512 K RAM.
Storage:	5 1/4-inch floppy.
Peripherals:	Monitor required to run model; printer optional.
Language:	Turbo Pascal.
Documentation:	Current version does not have a user's manual. The input processor is menu-based and very user friendly.

SECURITY CLASSIFICATION: Model data may be classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: The entire data base can be prepared in several hours if weapons performance data is readily available.

CPU time per Cycle: A cycle can be run in 5 minutes, and modest data changes can be made in 10-20 minutes. Consequently, a series of parametric runs can easily be made in one afternoon.

Data Output Analysis: See output.

Frequency of Use: Not yet established.

Users: BDM, Armor Family of Vehicles Task Force.

Comments: This model is derived from the combat subroutine in CORBAN and the COTES software at BDM Fort Leavenworth.

TITLE: PEJ Propagation Model - PLRS/EPLRS/JTIDS Propagation Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Vulnerability Laboratory, Ft. Monmouth, NJ 07703.

POINT OF CONTACT: William C. Barr, (201) 544-3769, AV 995-3769.

PURPOSE: The PEJ Propagation Model is a research and evaluation tool that predicts radio propagation path loss in the PLRS Band (420-450 MHz) and in the JTDS Band (960-1215 MHz).

DESCRIPTION:

Domain: Land.

Span: Local.

Environment: Calculates path loss for environment characterized by digitized terrain data.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: N/A.

CONSTRUCTION:

Human Participation: Required only to enter input data.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: N/A.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None currently planned.

INPUT: Latitude and longitude, frequency, and antenna height of the transmitter; latitude and longitude and antenna height of the receiver; elevation point spacing; and refractivity.

OUTPUT: Transmitter site elevation, receiver site elevation, transmitter bearing, receiver bearing, dominant propagation mode, path distance between the transmitter and receiver, path loss in decibels for the path, and free-space path loss for the same path.

HARDWARE AND SOFTWARE:
- Computer: MicroVAX (VMS).
- Storage: Not known.
- Peripherals: N/A.
- Language: FORTRAN.
- Documentation: Model description and users manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Depends on number of links being run.

CPU time per Cycle: Unknown.

Data Output Analysis: Unknown.

Frequency of Use: Not yet in use.

Users: U.S. Army Vulnerability Assessment Laboratory.

Comments: Propagation path loss data is input to other models and simulations that require it.

TITLE: PIVADS - Product Improved Vulcan Air Defense System Effectiveness Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Ballistic Research Laboratory (USABRL), Aberdeen Proving Ground, MD 21005-5066.

POINT OF CONTACT: Dr. Joseph K. Wald, AV 298-6669.

PURPOSE: The PIVADS Effectiveness Model simulates the effectiveness of the PIVADS in an engagement against a fixed- or rotary-wing aircraft executing an arbitrary flight profile.

DESCRIPTION:

Domain: Land and air.

Span: One-on-one engagement.

Environment: Clear day operations in flat terrain.

Force Composition: One PIVADS versus one helicopter or fixed-wing aircraft.

Scope of Conflict: Exclusively conventional.

Mission Area: Air defense.

Level of Detail of Processes and Entities: Individual weapon systems are modeled. PIVADS target tracking errors and fire control are modeled continuously, with bullet flyout and target damage calculations for each bullet.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Time-step model.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided; the aircraft does not reach to the PIVADS.

LIMITATIONS: Simulation is one-sided.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Ammunition characteristics, fire doctrine and burst policy, aircraft flight profile, aircraft vulnerability data.

OUTPUT: Engagement statistics, including kill probabilities and delivery errors.

HARDWARE AND SOFTWARE:

Computer: Cray 2/UNIX.

Storage: Approximately 125,000 bytes necessary at run time.

Peripherals: 1 terminal, 1 line printer.

Language: FORTRAN.

Documentation: BRL report: Product Improved Vulcan Air Defense System Effectiveness Model User Manual.

SECURITY CLASSIFICATION: Confidential.

GENERAL DATA:

Date Implemented: N/A.

Data Base: No formal data base required.

CPU time per Cycle: Typically 10 seconds per Monte Carlo replication.

Data Output Analysis: No postprocessing required.

Frequency of Use: Model completed and validated August 1988.

Users: U.S. Army Ballistic Research Laboratory (USABRL) and U.S. Army Materiel Systems Analysis Activity (USAMSAA).

Comments: Model structure is similar to that of the Modern Gun Effectiveness Model (MGEM).

TITLE: PLRS/EPLRS Deployment Aids - Connectivity Model

MODEL TYPE: Analysis (but can be used for training).

PROPONENT: Vulnerability Assessment Laboratory, C3I Vulnerability Assessment Division, SLCVA-CE Bldg. 2525, Ft. Monmouth, NJ 07703.

POINT OF CONTACT: Mr. Anthony L. Barnes, (201) 544-4166, AV 995-4166.

PURPOSE: The deployment aids model is used to select the number and position of dedicated PLRS or EPLRS relays, and the location of the MS.

DESCRIPTION:

Domain: Land and air.

Span: Accommodates any theater depending on terrain data base.

Environment: Terrain-based.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Electronic warfare.

Mission Area: Communications, data links.

Level of Detail of Processes and Entities: Individual nodes of the network.

CONSTRUCTION:

Human Participation: User provides the model with the deployment parameters and controls the decision-making process.

Time Processing: Static.

Treatment of Randomness: Path loss deterministically based on connectivity model.

Sidedness: One-sided.

LIMITATIONS: Homogeneous propagation environment, static deployment of elements, uniform statistical distribution of units, PLRS units, and line threat (not point jammers).

PLANNED IMPROVEMENTS AND MODIFICATIONS: A graphics interface to the model is being developed.

INPUT: User provides the deployment parameters.

OUTPUT: Plot of MS, relays, footprints.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a VAX computer with a VMS operating system.
Storage:	14,000 blocks (7 MB).
Peripherals:	One printer and one plotter.
Language:	FORTRAN.
Documentation:	Users manual and reference manual.

SECURITY CLASSIFICATION: Unclassified, but terrain data base may be classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Terrain data bases available from DMA.

CPU time per Cycle: Depends on configuration. Approximately one hour.

Data Output Analysis: Produces hard copies of data and plots.

Frequency of Use: Varies.

Users: LABCOM, CECOM.

Comments: The deployment aids model is linked to the connectivity model.

TITLE: POL - Petroleum, Oil, Lubricants

MODEL TYPE: Training and education (support of seminar war games).

PROPONENT: Wargaming Department, Naval War College.

POINT OF CONTACT: Micromodels Manager, (401) 841-3276.

PURPOSE: POL models intratheater commodities consumption and distribution patterns. It provides logistic data in support of larger-scale war games.

DESCRIPTION:
Domain: Sea.

Span: Intratheater.

Environment: N/A.

Force Composition: Combatant and replenishment ships, forward bases.

Scope of Conflict: N/A.

Mission Area: Logistics.

Level of Detail of Processes and Entities: POL is concerned with the segment of commodities movement that originates at advanced bases and terminates with delivery to operating forces. The user inputs initial commodities types and quantities, locations of advanced bases, compositions and locations of task groups, and locations and loading of replenishment ships.

CONSTRUCTION:
Human Participation: Initial data base inputs and iterative time-step specification.

Time Processing: Dynamic, time-step model.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: POL assumes optimal weather conditions and replenishment equipment and efficiency. User may modify task group consumption rates to simulate nonoptimal conditions. Input-intensive model.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None anticipated.

INPUT: Commodities type, quantity, and location; task group composition by ship type, location, and associated resupply port; combatant ship commodity consumption rate; replenishment ship load time, capacity, start load, speed, and assigned task group; port load factor, capacity, location, and inventory; time-step; and movement of task groups may be specified at each time-step.

OUTPUT: Results written to output file. Output consists of detailed summary of task group, replenishment ship, and port status, including commodities status and unit location. Output can be for start and final time-step only or for each time-step.

HARDWARE AND SOFTWARE:

Computer:	Dual disk drive IBM-compatible PC with 512K RAM.
Storage:	N/A.
Peripherals:	N/A.
Language:	FORTRAN.
Documentation:	User's manual, source code.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: April 1988.

Data Base: One hour.

CPU time per Cycle: N/A.

Data Output Analysis: Detailed summary of current status at end of time-step.

Frequency of Use: Several times per year anticipated.

Users: Wargaming Department, Naval War College.

Comments: POL is based on algorithms presented by CAPT. J. A. Peschka, USN, in "POL Support to Battle Forces in the Maritime Strategy," NWC 53-86. At NWC, it is used for logistical inputs into larger-scale war games. POL may also be useful for analytical study.

TITLE: PROLOGUE - Planning Resources of Logistics Units Evaluator

MODEL TYPE: Analysis.

PROPONENT: U.S Army Logistics Evaluation Agency (USALEA), New Cumberland, PA 17070-5007.

POINT OF CONTACT: James A. Cohick, LOEA-PL, (717) 770-6744, AV 977-6744.

PURPOSE: PROLOGUE is used to evaluate the logistics aspects of operation plans time-phased at the theater, echelon above corps, corps, and offshore base levels. It is specifically designed to serve as both an operations support and force capability tool to determine logistics units (maintenance, supply, and transportation) capabilities to perform wartime missions. PROLOGUE has also been used extensively to assist theater logistics planners to develop operation plan forces.

DESCRIPTION:

Domain: Land logistics support operations, intratheater.

Span: Global, theater, regional, or individual divisional force, depending on the time-phased force composition.

Environment: N/A.

Force Composition: U.S. Army time-phased force deployment units and the time-phased deployment nonunit data the Army supports.

Scope of Conflict: Conventional warfare.

Mission Area: Army maintenance of unit equipment and supply handling and transportation lift of supply and resupply of materiel.

Level of Detail of Processes and Entities: Maintenance units are evaluated as to their capabilities to complete direct and general support levels of maintenance. Supply units are evaluated as to their capabilities to handle war reserves and supply and resupply tonnages of materiel. Transportation units are evaluated as to their capabilities to lift local and line haul requirements.

CONSTRUCTION:

Human Participation: Required for processes.

Time Processing: Dynamic, time-step, relative to the time phasing of the force being evaluated.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Limited to the evaluation of logistics units on a time-phased force deployment list.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Include the following capabilities files: TDA/MOBTDA units, wartime host nation support resources, and interservice support agreements.

INPUT: Operation plan time-phased deployment force data, current unit equipment and personnel data, maintenance manhours for unit equipment, and geolocation data for locations in a theater.

OUTPUT: Computer printouts, raw data files, statistically analyzed data for wartime maintenance, and supply and transportation functions within a theater of operations.

HARDWARE AND SOFTWARE:

Computer:	UNIVAC 1100-71.
Storage:	N/A.
Peripherals:	Printer and terminals.
Language:	COBOL.
Documentation:	Local user manuals for modules.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: January 1985.

Data Base: N/A.

CPU Time per Cycle: 1 hour to 80 hours depending on the application.

Data Output Analysis: Detailed and summarized analyses.

Frequency of Use: Used continuously at USALEA to support its own missions. PROLOGUE is being installed at HQWESTCOM and will eventually be made available for export to other MACOMs.

Users: USALEA, HDQA ODCSLOG, and MACOMs.

Comments: USALEA has initiated action to include PROLOGUE for easy access and use by theater Army logistics planners.

TITLE: QJM - The Quantified Judgment Model

MODEL TYPE: Analysis, but has been used as a training model at CGSC and NDU.

PROPONENT: DATA MEMORY SYSTEMS, INC., 10392 Democracy Lane, Fairfax, VA, 22030, (703) 591-3674, Fax (703) 591-6109.

POINT OF CONTACT: Lt. Col. Peter J. Clark, USAF (Ret.).

PURPOSE: The QJM is an operation support tool used to analyze force-on-force combat engagements primarily at the division level, but is also used successfully at levels of aggregation from battalion to corps.

DESCRIPTION:
Domain: AirLand battle.

Span: Sector; accommodates theater by dealing with sectors successively.

Environment: Day and night operations, all seasons, 17 terrain choices, 12 weather choices, road net, and water barriers.

Force Composition: Joint and combined forces, BLUE and RED, may be entered manually or prestored in a forces data base using unique weapons scoring system (Operational Lethality Index).

Scope of Conflict: Conventional warfare.

Mission Area: All conventional ground force missions; air missions limited to close air support.

Level of Detail of Processes and Entities: Provides advance rate, personnel and armor attrition, and air attrition of organic aircraft.

CONSTRUCTION:
Human Participation: Required.

Time Processing: Engagements may be from one hour to five days at the discretion of the analyst. Under most circumstances results are provided in less than 15 minutes.

Treatment of Randomness: Advance and attrition rates are derived empirically (historical analysis) without Lanchestrian influences.

Sidedness: Two-sided, symmetric. Can be operated by a single analyst.

LIMITATIONS: Does not model air or naval war.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer: Hardware: IBM PC and compatibles.
Software: Copyright by DMSi.

Storage: N/A.

Peripherals: N/A.

Language: BASIC and Pascal.

Documentation: N/A.

SECURITY CLASSIFICATION: Unclassified without data, but forces programs are often classified.

GENERAL DATA:

Date Implemented: 1979.
Present version: 1987.

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: N/A.

Users: Boeing, LTV, Jet Propulsion Laboratory, CINCPAC, NDU, CIA, SHAPE Technical Center, USAREUR, and The Government of Jordan.

Comments: N/A.

TITLE: Radar Workstation

MODEL TYPE: Analysis.

PROPONENT: Technology Service Corporation, P.O. Box 1210, Dahlgren, VA 22448.

POINT OF CONTACT: Kim Simpson, (703) 663-9227.

PURPOSE: The Radar Workstation includes an integrated set of program modules for analyzing the performance of radar systems in clear and adverse environments. Application of the model includes parametric tradeoff analysis, theoretical performance prediction, and training of new radar analysts.

DESCRIPTION:

Domain: Land, air, sea, and space.

Span: N/A.

Environment: Surface or volume clutter, electronic countermeasures.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Models down to the radar component level: antenna, transmitter, signal processor, etc. Models environment in terms of atmospheric losses and propagation paths from radar to target. Considers mean characteristics of surface and volume clutter. Includes flexibility for a wide range of radar waveform types.

CONSTRUCTION:

Human Participation: Required for radar parameter inputs and selection of type of output.

Time Processing: Static for a specific dwell time on the target.

Treatment of Randomness: Processes are by direct computation.

Sidedness: One-sided.

LIMITATIONS: Radar frequency ranges from 100 MHz to 100 GHz.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Menu-driven operation, full-screen editing, input prompting, and help screen. Operator enters relevant radar and environmental parameters.

OUTPUT: High-resolution color graphics or printed results.

HARDWARE AND SOFTWARE:

Computer: IBM PC, XT, or AT with two disk drives or single disk drive plus hard disk; 8087 math chip processor.

Storage: 640K memory.

Peripherals: RGB color monitor, IBM CGA or EGA graphics adapter, dot matrix printer.

Language: "C," DOS 2.0 or later, Lotus 1-2-3 Version 2.

Documentation: User's guide and functional description manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: N/A.

Users: Government, industry, and consultants.

Comments: Version 2.0 was released in 1988. Version 2.1 will be released in 1989.

TITLE: RADGUNS - RAdar Directed GUN system Simulation

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Foreign Science and Technology Center/AIFREB, 220 Seventh Street NE, Charlottesville, VA 22901-5396.

POINT OF CONTACT: Mr. Dwight FitzSimons, (804) 980-7838, AV 274-7838.

PURPOSE: RADGUNS aids in evaluating the effectiveness of AAA systems against penetrating aerial targets. It can also evaluate the effectiveness of different airborne target characteristics (cross section, use of electronic countermeasures, maneuvers, etc.) against a specific AAA system.

DESCRIPTION:
Domain: Land, naval, and air.

Span: Individual.

Environment: Limited; simplified clutter or multipath models are implemented. Terrain modeling is limited to a single user-defined hill.

Force Composition: One AAA system versus one penetrating airborne target. RADGUNS models the full AAA system engagement, complete with user-specified operator delays and between radars. Can also model optical modes of AAA systems. Current support consists mainly of RED 23 mm, 30 mm, 35 mm, 40 mm, and 57 mm caliber AAA (radar or optical-directed) systems against very limited BLUE airborne targets.

Scope of Conflict: Conventional radar or optical-directed AAA.

Mission Area: One-versus-one AAA engagement.

Level of Detail of Processes and Entities: Single AAA system against a single airborne target. Probability of detection is based on pulse-by-pulse radar receiver model processing the returns of the target (including multipath) and ground clutter. Attrition of airborne target is probability of kill using target vulnerability tables and engagement characteristics. Both cumulative and single intercept probability of hit and probability of kill numbers are output.

CONSTRUCTION:
Human Participation: Not required; model not interruptable after input data has been entered.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic, using distribution theory to generate target probability of hit and probability of kill.

Sidedness: One-sided.

LIMITATIONS: Cannot support one-versus-many or many-on-many encounters. Terrain modeling is extremely limited. ECM routines limited to noise, inverse

gain, and range-gated walk-off techniques. No reactive maneuvering against a weapon system. Chaff and flares not modeled at this time.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Incorporation of a more flexible routine to build the run-time data files, an expanded self-protection system against AAA systems, an expanded airborne options, and self-protection equipment data bases.

INPUT: May be specified as answers to a series of program prompts if program is run in interactive mode or based on a user-constructed batch file.

OUTPUT: Depends on specifies simulation type and user selection. Can specify time-stepped tabular printouts of 6 of 25 user-selectable output parameters in addition to generating Tektronix 4115/4129 graphics display files.

HARDWARE AND SOFTWARE:

Computer:	IBM 3048 (MVS), VAX 11/780 (VMS), and SUN 3/260.
Storage:	N/A.
Peripherals:	Printer and optional Tektronix graphics terminal.
Language:	FORTRAN 77.
Documentation:	RADGUNS Technical Memorandum (users manual).

SECURITY CLASSIFICATION: Code is up to Secret NOFORN.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Internally hard-coded in program.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: Daily during course of a study.

Users: USAFSTC/AIFREB, AFCSA/SAGR, et al.

Comments: USAFSTC is trying to get JTCG acceptance of RADGUNS as the standard AAA model.

TITLE: RAPIDSIM - Rapid Intertheater Deployment Simulation Model

MODEL TYPE: Analysis.

PROPONENT: Logistics Directorate, The Joint Staff, The Pentagon, Washington, DC.

POINT OF CONTACT: Gail Sweet, (202) 694-7899, AV 224-7899.

PURPOSE: RAPIDSIM provides Joint Staff (J-4) planners with a deployment simulation model that helps achieve a rapid movement of combat and support units required for contingency operations. It is a research and evaluation tool that deals with force capability and requirements and resource planning.

DESCRIPTION:

Domain: Land, air, and sea.

Span: Accommodates any theater depending on data base.

Environment: N/A.

Force Composition: Joint and combined forces.

Scope of Conflict: Conventional.

Mission Area: Conventional mission.

Level of Detail of Processes and Entities: Individual aircraft and ships.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step and event-step.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Requires FORTRAN compiler and cannot be executed on a PC.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Scenario builder produces environment for the simulation (airlift/sealift assets, capacities, availabilities). MORSA Data Base System produces movement requirements from OPLAN TPFDDs and JPAM data bases.

OUTPUT: Provides detailed reports on simulation activity and produces tabular reports and graphic displays. Postprocessor is available to produce additional reports.

HARDWARE AND SOFTWARE:

Computer:	Runs on the VAX under VMS and the IBM under TSO.
Storage:	75 MB.
Peripherals:	Minimum requirements: one printer and one terminal.
Language:	FORTRAN.
Documentation:	RAPIDSIM manual.

SECURITY CLASSIFICATION: Model is unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1970.

Data Base: Two days.

CPU time per Cycle: Size dependent (from 5 to 40 minutes of CPU time).

Data Output Analysis: Graphic displays and tabular reports produced by postprocessor aid in analysis.

Frequency of Use: N/A.

Users: Naval War College, CENTCOM, EUCOM, Joint Warfare Center, PACOM.

Comments: N/A.

TITLE: RCN - Radio Communications Network Model

MODEL TYPE: Analysis.

PROPONENT: Center for C3 Systems, CECOM.

POINT OF CONTACT: Frank Giordano, AV 995-2128.

PURPOSE: The RCN Model is a research and evaluation tool used for determining the performance of packet radio networks operating under channel access protocols of ALOHA, SLOTTED ALOHA, CSMA, and SLOTTED CSMA.

DESCRIPTION:

Domain: Land.

Span: Local.

Environment: Models electromagnetic environment and various channel access protocols.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: Communications.

Level of Detail of Processes and Entities: Entity: network. Processes: communications.

CONSTRUCTION:

Human Participation: Required for description of communication network.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: N/A.

LIMITATIONS: 30 nodes.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Topology, routing scheme, and communications traffic load.

OUTPUT: Offered traffic versus throughput and number of packets transmitted/received/lost.

HARDWARE AND SOFTWARE:

Computer (OS):	VAX, MicroVAX, VMS.
Storage:	2 MB RAM and 30 MB hard disk.
Peripherals:	Printer.
Language:	General Simulation System (GSS).
Documentation:	N/A.

<u>SECURITY CLASSIFICATION</u>: Unclassified.

<u>GENERAL DATA</u>:

<u>Date Implemented</u>: March 1987.

<u>Data Base</u>: N/A.

<u>CPU time per Cycle</u>: N/A.

<u>Data Output Analysis</u>: N/A.

<u>Frequency of Use</u>: N/A.

<u>Users</u>: N/A.

<u>Comments</u>: N/A.

TITLE: RECCE - Reconnaissance Mission Planning Aid

MODEL TYPE: Analysis.

PROPONENT: AF Electronic Warfare Center/Studies & Analysis Directorate, San Antonio, TX 78243-5000.

POINT OF CONTACT: Capt. Don Mikneus, AFEWC/SAVC, AV 945-2296.

PURPOSE: The RECCE model is a research and evaluation tool dealing with weapon radar and communications systems. The model is used to predict the effectiveness of a reconnaissance system's ability to collect ELINT/COMINT data for a specified order of battle.

DESCRIPTION:

Domain: Real-world location in 3-D earth/atmosphere space.

Span: Can be global, but results are easiest to use when the span is regional or local.

Environment: Graphic positioning display shows map of coastal features. Calculations incorporate Defense Mapping Agency terrain data. Cultural features will be incorporated as an upgrade.

Force Composition: Combined RED, GREEN, and GREY force structures.

Scope of Conflict: Accounts for jamming effects and surface-to-air threat areas.

Mission Area: Reconnaissance.

Level of Detail of Processes and Entities: The smallest entity modeled is a transceiver system. The primary calculations of the model perform a power density comparison for all systems in the scenario.

CONSTRUCTION:

Human Participation: Required for decisions. The program waits for decisions.

Time Processing: Static (time snapshot).

Treatment of Randomness: Deterministic, no randomness.

Sidedness: 3-sided (transmitters, jammers, and receivers). Receiver reaction to transmitters and jammers is modeled.

LIMITATIONS: Each run is limited to power density considerations of no more than 5,000 transmitters, no more than 25 jammers, and only one receiver system having no more than 10 receiver stations.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Speed.

INPUT: Propagation model type (interactive). Transmitter, jammer, receiver data (frequency, power, location, etc.), and terrain data. Input can be by hand, by computer transfer, by collection, or real-time ELINT/COMINT data.

OUTPUT: Color graphic and text summary of each one-on-one system interaction.

HARDWARE AND SOFTWARE:

Computer:	MicroVAX running VAX/VMS.
Storage:	Minimum of 150 MB to store program and data.
Peripherals:	Tektronix graphics display required and Tektronix or Bruning color plotter desired.
Language:	FORTRAN, STI Tektronix graphics interface.
Documentation:	User's manual, October 1988, and maintenance manual, December 1988.

SECURITY CLASSIFICATION: Unclassified (without data).

GENERAL DATA:

Date Implemented: Version 1.0, November 1987; Version 2.0, July 1988; Version 3.0, December 1988.

Data Base: One-time data input and review; 2 minutes per transmitter or receiver; jammer loading for each scenario may be time intensive.

CPU Time per Cycle: Five seconds for each transmitter, each jammer, and each receiver location. For a scenario involving 10 transmitters, 2 jammers, and 6 receiver locations, the CPU time required is 120 seconds.

Data Output Analysis: Left to the user.

Frequency of Use: Used for special mission planning, training exercises, and scenario analysis.

Users: Warrior Preparation Center, certain ESC ESS detachments.

Comments: Uses same data and interface as AFEWC's Improved Many on Many model.

TITLE: Research, Evaluation, and Systems Analysis (RESA) Facility (formerly Interim Battle Group Tactical Trainer [IBGTT])

MODEL TYPE: Analysis.

PROPONENT: Naval Ocean Systems Center, San Diego, CA 92152

POINT OF CONTACT: Dr. Tom Fitzgerald, (619) 553-3968, AV 533-3968.

PURPOSE: RESA is a research and evaluation tool for systems analysis and testing associated with naval command, control, and communications systems. It is also used for operation plan evaluation, command and control training support for senior officers, joint C3 interoperability assessment, warfare systems architecture analysis, and wargaming support.

DESCRIPTION:

Domain: Naval and air operations; limited land warfare modeling.

Span: Focus on naval battle group/force operations in the theater context.

Environment: Weather conditions in 24 geographic regions affect flight operations weapons and sensor performance. Four acoustic environment conditions affect sonar performance.

Force Composition: Naval ships, submarines, bases, and air forces; air force bases and air elements; BLUE, ORANGE, and NEUTRAL.

Scope of Conflict: Mostly conventional. Modeled nuclear effects available.

Mission Area: All naval conventional areas; limited mine warfare and amphibious operations capabilities; joint air defense and strike operations.

Level of Detail of Processes and Entities: Models battle group and force at level of ships, submarines, and aircraft (individual units or collective flights) and associated weapons, sensor, and C3I systems. Includes models of shore bases and wide-area surveillance systems and surveillance satellites that may support battle force operations. Record and link communications models affect perceived tactical situation. Logistics available from ships and bases modeled. Kinematics models include navigation error.

CONSTRUCTION:

Human Participation: Responses to tactical situation must be made. May replicate scenario activities of forces by prescript of force actions or scenario with new random number seed in auto-replay mode.

Time Processing: Time-step at user-defined rate from 3-400 seconds per game cycle. In large scenarios may be limited to 15-30 seconds per game cycle depending on host computer. One game cycle equals one game minute.

Treatment of Randomness: Stochastic, direct computation of a physical parameter and Monte Carlo determination of result.

Sidedness: Basically two-sided, symmetric, reactive. BLUE and ORANGE forces may be partitioned into up to nine views of the tactical situation. A NEUTRAL side may also be defined and operated by the control function.

LIMITATIONS: No land warfare or terrain modeled. Scenario size limited to 400 units (being expanded to 4096).

PLANNED IMPROVEMENTS AND MODIFICATIONS: Current development of terrain model and improved mining, amphibious, and naval coastal operations; current expansion of force unit capacities; and planned improvement of land warfare and air-to-ground operations models.

INPUT: Characteristics of forces, weapons, sensors, and C3I systems. Definition of scenario initial force locations, C3I networks, environmental conditions, and wide-area surveillance systems in use.

OUTPUT: Minute-by-minute tactical situation in geographic plot format and 30 menus of alphanumeric data pertinent to situation; postgame analysis printouts of all force positions, detections, engagements, and communications occurring during the scenario; and perhaps LINK-11, RAINFORM, and JINTACCS formatted message streams in response to scenario events.

HARDWARE AND SOFTWARE:

Computer:	VAX computer with VMS operating system.
Storage:	100,000 blocks for executables, files, and data base for moderate scenario.
Peripherals:	One command center includes one VT-100 (or equivalent) input-output terminal, one geographic display (e.g., TEKTRONIX 4209) and up to four VT-100s for status board displays. Software allows up to 16 command centers per remote site computer and host computer to drive up to 16 remote site computers.
Language:	Rational FORTRAN (RATFOR).
Documentation:	Analyst Users Guide (five volumes).

SECURITY CLASSIFICATION: Unclassified. Typically requires data bases with secret data. Unclassified data base being developed.

GENERAL DATA:

Date Implemented: 1982.

Data Base: Modifiable characteristics data bases and scenario files.

CPU time per Cycle: Scenario dependent; most run at 2-1 or better.

Data Output Analysis: Limited to a few tailored processes.

Frequency of Use: Approximately 20 exercises per year at NOSC.

Users: NOSC, Naval Postgraduate School, Naval War College, NSWC, NRL, DCA, RADC, Warrior Preparation Center (Ramsteing AFB, FRG), U.S. Army CECOM, U.S. CINCPAC, U.S. CENTCOM, and ROK/US Combined Forces Command.

Comments: Was basis for initial development of ADSIMS (now AWSIMS). Basic simulator for JDLNET to provide distributed joint C3I analysis support.

TITLE: RETCOM - Return to Combat

MODEL TYPE: Analysis.

PROPONENT: Logistics Center, Ft. Lee, VA.

POINT OF CONTACT: Charles Holmes, AV 687-3347/3610.

PURPOSE: RETCOM was designed to examine the reliability, availability, and maintainability (RAM) of candidate ground weapon systems in COEAs and of a single system type belonging to a peacetime or combat force engaged in a series of activities and missions. During these missions, systems that have suffered combat damage are if possible repaired and returned to the force. RETCOM differs from force-on-force models in that the BLUE forces' activities are portrayed to generate maintenance requirements, not RED casualties.

DESCRIPTION:

Domain: Land.

Span: Defined mission scenario and associated levels of maintenance.

Environment: None necessary.

Force Composition: User defines BLUE organization as a major unit (e.g., division, battalion, or task force) composed of subunits (e.g., companies) to which systems are assigned. User may define his combat units as companies, platoons, squads, or any combination thereof, and need not assign the same number of systems to each combat unit.

Scope of Conflict: BLUE weapon systems are represented for RAM by subsystems and for combat damage by exposed areas vulnerable to enemy munitions. User defines enemy weapons by specifying the different RED weapon types.

Mission Area: Combat force missions.

Level of Detail of Processes and Entities: Combat attrition portrayed as a function of the enemy weapon array and rate of fire. BLUE system posture and unit strength or number of unit systems committed to action. Processes such as attrition, system performance, combat damage, system abandonment, maintenance demands, deferred unscheduled maintenance downtime, and scheduled and unscheduled maintenance downtime affect above entities.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic.

Sidedness: One-sided.

LIMITATIONS: No geography and no RED casualties.

PLANNED IMPROVEMENTS AND MODIFICATIONS: To make the program/model available to IBM compatible desktop computers.

INPUT: Number of systems to be simulated; maintenance structure control variables; recovery; number of systems available for missions, RED weapon types available, and BLUE systems; combat hit rate; sampling distributions; normal damage assessment; active repair time; cannibalization; random number generator; maintenance assets; number of recovery vehicles, replications, missions segments, and combat units; total maintenance elements; number of maintenance elements in battalion and crew; number of systems per combat unit; special maintenance equipment; vulnerable area description; combat attrition control tables and damage repair data; mechanical subsystem description and repair data; RAM repair location; preventive maintenance; and alternate spare data.

OUTPUT: Printed summary information describing the results of each individual replication and all cumulative replications for a given alternative such as distance traveled by the system; fuel used by the system; rounds fired by the system's primary, secondary, and tertiary weapons; total maintenance downtime during the scenario; deferrable maintenance downtime during the scenario; operational uptime; standby time; operational availability; total outstanding maintenance hours remaining after end of the scenario; nondeferrable outstanding maintenance hours remaining; outstanding preventive maintenance hours remaining; delay time without cannibalization and using cannibalization; total unscheduled maintenance actions; deferrable unscheduled maintenance actions; nondeferrable unscheduled maintenance actions; and the number of nonrecoverable incidents, scheduled maintenance actions, repairs necessitated by combat damage, irreparable combat occurrences, nonrecoverable combat damaged systems, and replaced systems.

HARDWARE AND SOFTWARE:

Computer:	SPERRY 1100 series/SPERRY Executive Language.
Storage:	N/A.
Peripherals:	Printers and modems.
Language:	SIMSCRIPT II.5.
Documentation:	N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 19 April 1985.

Data Base: Time needed to prepare data base.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: N/A.

Users: N/A.

Comments: Any further information required is available in the user's manual. RETCOM is a TRADOC model.

TITLE: REVAM - RPV EW Vulnerability Assessment Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Vulnerability Assessment Laboratory, LABCOM, Ft. Monmouth, NJ 07703.

POINT OF CONTACT: Peter Bothner, (201) 544-3773.

PURPOSE: REVAM is used to analyze the EW performance of RPV data links.

DESCRIPTION:

Domain: Ground-to-air model.

Span: Intended for 100 km x 100 km area.

Environment: Models the signal and EW environment to determine data link performance.

Force Composition: Considers RED and BLUE deployment and employment strategies and terrain to establish anticipated levels of performance.

Scope of Conflict: Conventional warfare only.

Mission Area: Developed to validate artillery target acquisition mission of the RPV.

Level of Detail of Processes and Entities: Model was developed to perform parametric analyses of data link EW performance based on RED and BLUE deployments, tactics, threat levels, and terrain.

CONSTRUCTION:

Human Participation: Menu-driven interactive model.

Time Processing: Approximate run time is one half hour per RPV flight profile.

Treatment of Randomness: Deterministic model that can be used to compare one run with others.

Sidedness: Only one operator can exercise the model at any given time.

LIMITATIONS: REVAM is written in HP BASIC, which limits it transportability. Currently, REVAM does not model multipath or weather.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Model architecture readily lends itself to improvements and modifications. However, there are no funds available to pursue enhancements.

INPUT: SCORES scenarios, data link and threat characteristics, tactics, RPV flight profiles, and propagation losses.

OUTPUT: Printouts of all data files, plots scenario laydown, and plots J/S environment at the antenna and at the output of the adaptive antenna processor to reveal AJ margin of the data link.

HARDWARE AND SOFTWARE:

Computer:	HP9836 desktop computer.
Storage:	One MB RAM and two 5.25-inch double density floppy disk drives.
Peripherals:	HP-compatible matrix printer and plotter.
Language:	HP BASIC.
Documentation:	Available from Hewlett Packard.

SECURITY CLASSIFICATION: Classification depends on the input and output data, which are normally SECRET. REVAM source code is unclassified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: DMA terrain data, SCORES scenarios, and any desired threat data classified below top secret.

CPU time per Cycle: Problem-dependent.

Data Output Analysis: Data output selected by the analyst is reduced and plotted by the model.

Frequency of Use: Varies.

Users: LABCOM, TECOM, and MICOM.

Comments: REVAM should be coded in FORTRAN to improve transportability.

TITLE: RSAS - Rand Strategy Assessment System

MODEL TYPE: Analysis (but has been used as a training model/exercise driver).

PROPONENT: Director, OSD/NA, The Pentagon, Room 3A930, Washington, DC 20301.

POINT OF CONTACT: Colonel Robert Gaskin, (202) 697-1312, AV 227-1312.

PURPOSE: RSAS provides a laboratory for the analysis of military strategy and operations in which alternative strategies and operations are evaluated in terms of the robustness of outcomes across the inherent range of uncertainty in scenarios, performance factors, and rules of war. RSAS can also be used for training and other requirements.

DESCRIPTION:

Domain: Land, air, sea, and limited space.

Span: Conventional and nuclear combat in data bases representing Northern, Central, and Southern Europe; Korea; and Southwest Asia theaters; naval combat in all oceans and major seas.

Environment: Four environments: main theater model (CAMPAIGN), alternate theater model (CAMPAIGN-ALT), naval model, and nuclear models. CAMPAIGN's geographic resolution is moderate and grid-based. Terrain is considered in an aggregate fashion as a function of the effect of terrain on maintaining or executing an offense or supporting a stalemate. CAMPAIGN-ALT encompasses a network of points and LOCs that explicitly account for terrain factors and geographic constraints in force movements and combat adjudication. The naval model allows aggregate differences in ASW, AAW, and ASUW in ocean regions based on variations in acoustic and environmental conditions. Nuclear models consider only environmental factors implicitly included in damage assessment criteria.

Force Composition: Nuclear forces played at individual weapon and weapon platform level. BLUE, RED, and GREEN joint and combined forces portrayed worldwide via a data base resident in the model.

Scope of Conflict: Theater and global conventional, theater nuclear, or strategic nuclear.

Mission Area: All conventional, theater, nuclear, and strategic nuclear areas.

Level of Detail of Processes and Entities: Individual weapons and weapon platforms modeled in the nuclear models. In the CAMPAIGN model, ground forces are modeled at the level of RED divisions and BLUE brigades (including most allied forces), air forces at the level of RED air regiments and BLUE air squadrons, and naval forces at the level of individual ships. Combat adjudication highly aggregated, but includes many parameters affecting theater-level combat that are only implicitly controlled by more fine-grain models. Combat adjudication output includes force attrition, FLOT location, force ratios, and aggregate damage levels.

CONSTRUCTION:

Human Participation: Permitted for all decisions, but the system can be run in an automatic mode relying on scripted decision log that makes all national-level, strategic, and theater-level decisions.

Time Processing: Dynamic, time- and event-step. Events at 12-hour, 4-hour, or 6-minute intervals depending on combat type.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, asymmetric, and reactive. Single operator can test and operate model.

LIMITATIONS: Continuous development intended to identify and improve areas of limitation.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Areas of limitation are being improved as recommended by DoD Steering and Working groups, with the authorization of OSD/NA. Additional land theaters are under development.

INPUT: Model comes delivered and ready to run.

OUTPUT: Graphic and tabular output of the results of combat adjudication. Comparison of multi-scenario runs also possible.

HARDWARE AND SOFTWARE:

Computer:	Run on a SUN 3 family of systems under SUN OS 3.5.
Storage:	300 MB of disk space and 12 MB of memory recommended.
Peripherals:	Printer if desired.
Language:	"C" and RAND-ABEL (which compiles into "C").
Documentation:	Extensive descriptive documentation, but no true operating manual. Operating documentation being developed by a subcontractor.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: 1988 (development began in 1983.)

Data Base: A complete, easily modifiable data base accompanies the model.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: Varies by command, but is used at least several times per year with increasing frequency by those listed below.

Users: OSD, the Joint Staff, NDU, Naval Postgraduate School, Air College, CIA, DIA. Other users coming on line: PACOM, EUCOM, and other CINCs.

Comments: J-8 is currently evaluating model. RAND point of contact is Dr. Bruce Bennett, (202) 296-5000.

TITLE: RWAM - Revised Weapon Allocation Model

MODEL TYPE: Analysis.

PROPONENT: Force Structure, Resource, and Assessment Directorate (J-8), The Pentagon, Washington, DC.

POINT OF CONTACT: Marion T. Davis J-8/NFAD (202) 697-8530, AV 227-8530.

PURPOSE: RWAM is used to evaluate the impact of nuclear weapons against a battlefield target array.

DESCRIPTION:

Domain: Land.

Span: Can accommodate a target array composed of any number of individual elements.

Environment: N/A.

Force Composition: Any mix of battlefield forces may be portrayed.

Scope of Conflict: Theater nuclear.

Mission Area: Nonstrategic battlefield.

Level of Detail of Processes and Entities: Allows for specific targeting by target type, location, and weapon system. Time is not considered.

CONSTRUCTION:

Human Participation: None.

Time Processing: Static.

Treatment of Randomness: Monte Carlo. A random number generator is used for determining AGZ's target locations, acquisition levels, targeting priorities, and conventional attrition.

Sidedness: One-sided.

LIMITATIONS: Model measures prompt blast effects only.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Requirements include the target array, weapon systems, general characteristics, and radii of kill data specified scenario files.

OUTPUT: Number of target acquisitions, number of hits on target elements, and the number of kills within the target array. Graphic output of weapon laydown is available.

HARDWARE AND SOFTWARE:

Computer: DEC VAX series (VMS).

Storage: Unknown.
Peripherals: One printer, one VT 100 terminal, and a graphics-capable printer.
Language: VAX-11 FORTRAN.
Documentation: User's manual and program maintenance guide.

SECURITY CLASSIFICATION: Model code is unclassified.

GENERAL DATA:

Date Implemented: September 1986.

Data Base: Battlefield arrays.

CPU time per Cycle: 1-10 minutes.

Data Output Analysis: Raw data and summary statistics.

Frequency of Use: As required.

Users: The Joint Staff/J-8.

Comments: N/A.

TITLE: SAAMBO - Signature of Air-to-Air Missiles after Burnout

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. William McQuay, (513) 255-2164.

PURPOSE: SAAMBO is a research and evaluation tool that calculates the aerodynamic heating and thermal signatures of high speed, low acceleration airborne vehicles. The output from SAAMBO may be used as input to engagement or system models that require target IR signature information.

DESCRIPTION:

Domain: Air.

Span: Local and individual.

Environment: Appropriate atmospheric parameters extracted based upon user-specified vehicle altitude.

Force Composition: Individual airborne vehicles.

Scope of Conflict: AAMs, cruise missiles, long-range AAMs, or constant velocity aircraft.

Mission Area: SAAMBO predicts that portion of the IR signature of airborne vehicles caused by aerodynamic heating.

Level of Detail of Processes and Entities: The subject vehicle is modeled as a combination of generic surfaces with similar thermal and radiometric properties. Typical subsections include a hemispherical nose dome, a conical transition section, a cylindrical fuselage, a trapezoidal wing or canard, and a cylindrical leading wing edge. SAAMBO calculates the transient aerodynamic heating radiance from an AAM target or the steady-state thermal radiance from an object such as a low acceleration aircraft. It calculates the skin temperature and the resultant radiant emittance as a function of time during vehicle flight. SAAMBO also extracts appropriate atmospheric parameters (based upon the United States Standard Atmosphere) according to the user-specified vehicle altitude.

CONSTRUCTION:

Human Participation: Not required. Model not interruptable.

Time Processing: Dynamic, closed form.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: Of the major contributors to IR emissions, the program only simulates skin thermal emissions; it does not characterize the plume, thermal output from the engine, or sun glint. Secondly, the program was designed to simulate the nose on aspect angle.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: User-divided vehicle subsections. A simplified vehicle may be reasonably characterized by four to eight surfaces. User specifies vehicle altitude.

OUTPUT: Spectral radiant exitance and intensity values as a function of time. Output is printed and appears in table format.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	30,042 bytes.
Peripherals:	Printer.
Language:	FORTRAN 77.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: September 1982.

Data Base: N/A.

CPU time per Cycle: Typically 6.7 seconds.

Data Output Analysis: Manual analysis of tabular results.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: SAB - Surface-Air Battle

MODEL TYPE: Training and education (support of seminar war games).

PROPONENT: Wargaming Department, Naval War College.

POINT OF CONTACT: Micromodels Manager, (401) 841-3276, AV 948-3276.

PURPOSE: SAB models air-to-air, air-to-surface, and surface-to-air detections and engagements (including ship- and sub-launched ASCMs). It is designed to support battle damage assessment in conjunction with larger-scale war games.

DESCRIPTION:

Domain: Sea.

Span: Local.

Environment: N/A.

Force Composition: Attacking and defending aircraft, ship formations.

Scope of Conflict: Conventional battle group sea strike, AAW, ASMD weapons.

Mission Area: Strike warfare, AAW, ASMD.

Level of Detail of Processes and Entities: User defines geographic area, strike composition, armament and flight profiles, and defender CAP stations/armament, and ship formation.

CONSTRUCTION:

Human Participation: Required for initial inputs only.

Time Processing: Closed form.

Treatment of Randomness: Outcomes stochastically based on direct computation of probabilities, with Monte Carlo determination of results.

Sidedness: Two-sided, symmetric.

LIMITATIONS: User input-intensive.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Add surface-to-surface capability.

INPUT: Geographic location, strike composition, armament and flight profiles, defender CAP stations/armament and ship formation.

OUTPUT: Cumulative aircraft losses, individual ship damage and loss (including list of damaged ship components), azimuth and elevation of individual weapon hits.

HARDWARE AND SOFTWARE:

Computer: IBM-compatible PC with 512K RAM.

Storage: N/A.

Peripherals: Printer.
Language: "C," dBASE III+.
Documentation: User's manual, design description, source code.

SECURITY CLASSIFICATION: Unclassified, but data base is classified.

GENERAL DATA:
Date Implemented: 1988.

Data Base: One hour.

CPU time per Cycle: N/A.

Data Output Analysis: None.

Frequency of Use: Several times per year anticipated.

Users: Wargaming Department, Naval War College.

Comments: SAB is designed to be used in conjunction with the Kinematics and Strike models. Data bases are compatible. Users should be able to move freely among all three models. Ship battle damage results are determined by calling SHIPDAM model as a subroutine. SAB may be used independently to provide battle damage assessment information in support of larger war games.

TITLE: SAR - Search and Rescue

MODEL TYPE: Analysis.

PROPONENT: USCG R&D Center, Marine Systems Branch, Avery Point, Groton, CT 06340-6096.

POINT OF CONTACT: Clark Pritchett, (203) 441-2653, FTS 642-2653.

PURPOSE: SAR is designed to compare the capabilities of alternative vessels in search and rescue that are being considered for acquisition. This model is a research tool that deals with force capability.

DESCRIPTION:

Domain: Coastal.

Span: Individual rescue vessel.

Environment: Sea state distribution, wind, current, time of day, and sunrise and sunset.

Force Composition: One vessel plays against a distribution of cases.

Scope of Conflict: A case is represented by the survival function, i.e., the probability that the mariner is alive as a function of time.

Mission Area: Search and rescue--may be used for responsive naval missions.

Level of Detail of Processes and Entities: A case is the smallest entity modeled. Cases are processed one at a time, and the results are logged as a life saved, not saved, or not found. Search is based on Koopman's optimal search of an ellipse. Search time changes from day to night and increases as wind and current increase the CEP.

CONSTRUCTION:

Human Participation: Required only for gathering input.

Time Processing: Dynamic; cases stepped through events.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided model in that one rescue vessel is played against a caseload represented by distributions of weather, distance, time of day, CEP, and survival curve.

LIMITATIONS: The measuring stick for the case is the survival function, which is not well defined for search and rescue.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None at this time.

INPUT: Case information (i.e., distributions), vessel speed in a seaway environment, and the survival function make up the majority of the inputs.

OUTPUT: Produces vessel operational performance and mission MOEs.

HARDWARE AND SOFTWARE:

Computer:	VAX family of computers with VMS.
Storage:	Minimal.
Peripherals:	Terminal and printer.
Language:	FORTRAN.
Documentation:	A report describing the model is available.

SECURITY CLASSIFICATION: None.

GENERAL DATA:

Date Implemented: 1986.

Data Base: None.

CPU time per Cycle: Small.

Data Output Analysis: Graphic postprocessor is available.

Frequency of Use: SAR is in the preliminary stage of acquisition.

Users: Coast Guard R&D Center.

Comments: This model could be applied to other operations, such as responding to patrol boat or terrorist attacks.

TITLE: SAS - Strategic Nuclear Attack Planning

MODEL TYPE: Analysis.

PROPONENT: Joint Staff, Force Structure, Resource, and Assessment Directorate (J-8), The Pentagon, Rm 1E965, Washington, DC 20318-8000.

POINT OF CONTACT: Cdr. D. K. Meier (J-8), (202) 695-2020.

PURPOSE: The SAS is a high-level, interactive, global- or theater-level war game. SAS plays ground, air, sea and space forces; systems in crisis; conventional conflict; and chemical or nuclear (theater or strategic) warfare. SAS includes a global logistics functional capability as well as strategic mobility (sealift and airlift).

DESCRIPTION:

Domain: Land, air, sea, and space.

Span: Global and theater.

Environment: N/A.

Force Composition: Combined and joint, BLUE and RED.

Scope of Conflict: Conventional, chemical, and nuclear (theater or strategic).

Mission Area: National military strategy; global or theater war fighting; strategic mobility options; allocation and reallocation of ground, air, and naval forces; crisis containment and deterrence; and escalation control.

Level of Detail of Processes and Entities: See above.

CONSTRUCTION:

Human Participation: The simulation is user-friendly, and no previous gaming experience is required for players to be successful. SAS is highly flexible and has relatively simple data base requirements. SAS provides participants with an opportunity to move rapidly through a scenario, focusing on analysis of the events and phenomena that would dominate the outcome of the scenario.

Time Processing: Unknown.

Treatment of Randomness: Unknown.

Sidedness: Two-sided, asymmetric.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: (Manual) Order of battle for each nation, weapon system (armored division equivalents [ADEs], aircraft squadrons, ships, other assets) status and location, ground force unit strengths (expressed in ADEs), ADE conversion factors including divisional fire power and armored vehicle components.

OUTPUT: (Manually calculated) Separate battles are independently adjudicated and reported. The effectiveness of remaining individual "weapon systems" is reported. Summary results are provided at the end of each turn. The results are OPORDER reports, combat reports, logistics depot reports, military sealift reports, and force summary reports. Miscellaneous status information is also available to players on request.

HARDWARE AND SOFTWARE:
Computer: Manual simulation.
Storage: N/A.
Peripherals: N/A.
Language: N/A.
Documentation: N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: January 1983.

Data Base: Data base preparation takes six weeks.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: One to four times per year.

Users: OSD/NA

Comments: SAS is played in two-hour sessions, twice daily.

TITLE: SCARE - Simulation and Countermeasure, Aircraft, and Radar Encounters

MODEL TYPE: Analysis.

PROPONENT: Mission Research Corporation, 735 State Street, P. O. Drawer 719, Santa Barbara, CA 93102-0719 for AFWAL/AAWP-3, Wright-Patterson Air Force Base, OH 45433-6543.

POINT OF CONTACT: Dr. G. E. Johnson (MRC), (805) 963-8761 ext. 356, or D. Lin (AAWP-3), (513) 255-5076.

PURPOSE: This research and evaluation tool evaluates the effectiveness of self-protection countermeasures against AA systems. It models aircraft and AA systems in fine detail and high fidelity. It also evaluates a data base for automated threat assessment and reaction systems, assesses the ECCM capabilities of radar systems, and serves as a testbed for the development of real-time radar and countermeasure simulations.

DESCRIPTION:

Domain: Aircraft vs. land-based, surface naval AAA or SAM, and airborne interceptor AAM.

Span: Local or individual.

Environment: Engagement over flat earth and select atmospheric attenuation conditions. Neglects ground effects except where required (noncoherent MTI).

Force Composition: BLUE aircraft on RED, GRAY, or BLUE AA systems.

Scope of Conflict: Conventional; mostly tactical aircraft and anti-aircraft systems with many long-range strategic systems.

Mission Area: Penetration through hostile forces by aircraft, air-to-air combat, and survival of aircraft in close air support.

Level of Detail of Processes and Entities: Depends on module and function. Emulates each functional block of radar systems. Includes saturation, AGC, servo loops, target detection, loss, acquisition and reacquisition, search, track, and radar operator interventions. Radar models maintained at several levels of detail. Models aircraft trajectory and radar signature. Trajectory and radar signatures of expendable countermeasures (chaff and decoys) are included together with (passive) radar cross-section modulation models. Active ECM models include selectable waveform modulations, directivity patterns, ERPs, and bandpass (repeater) characteristics. Missile seeker and guidance models developed at emulation level. Missile flyouts governed by input aerodynamic, thrust, mass, and control surface models. SCARE accepts measured data to the greatest degree possible yet provides engineering models to fill data gaps.

CONSTRUCTION:

Human Participation: None; simulation events selected before run time.

Time Processing: Dynamic, event-driven. Each module runs asynchronously with its own time scale requirements.

Treatment of Randomness: Deterministic with stochastic, Monte Carlo processes. Receiver noise, aerodynamic turbulence, and target glint stochastically sampled each run. In the more efficient models values are generated as a function of expected value.

Sidedness: Two-sided, asymmetric, reactive. Reactive anti-aircraft threats go through search, acquisition, track reacquisitions, weapon launches, and flyouts in response to target aircraft. Countermeasure deployments and maneuvers are selected before run time, but repeater jammer and certain maneuvers are reactive.

LIMITATIONS: No geography, five DOF missile models, and limited multipaths.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Efficient, near real-time modules of existing threats are under development.

INPUT: Flexible, keyword-driven input routines with complete set of default values; tabular input.

OUTPUT: User selectable at many levels. Principle outputs are missile miss distances at closest approach to aircraft and radar tracking errors. MRC maintains shell processes for automated parametric studies.

HARDWARE AND SOFTWARE:

Computer:	Portable; runs on VAX/VMS systems and CDC CYBER; has been installed and tested on several DOS microcomputer systems.
Storage:	Executable images generally about one MB.
Peripherals:	Terminal, printer, and graphics output (TEKTRONICS or emulator) device required to reach full potential of SCARE.
Language:	FORTRAN 77 plus supporting command procedures.
Documentation:	More than 11 user guides and 18 published reports.

SECURITY CLASSIFICATION: Unclassified; data classified up to S/WNTEL/NOFORN.

GENERAL DATA:
Date Implemented: 1977.

Data Base: Development of required input data from measurement programs and flight tests typically takes several man-months.

CPU time per Cycle: Depending on modules and complexity of engagement, typically runs 10 to 100 times slower than real time on microVAX II.

Data Output Analysis: Postprocessors produce tabulated and plotted parametric studies.

Frequency of Use: Continuously used by MRC under contract to users below.

Users: AFWAL/ENAMA, NWC China Lake, PMTC, NSWC, and WSMR. SCARE requested and used by AFWAL/AARM-3, AFEWS/SATR, ASD/ENAMA, and others.

Comments: Maintains backward compatibility. New models continually added and models revised as new data is available.

TITLE: SCAT - Sea Control Analysis Tool

MODEL TYPE: Analysis.

PROPONENT: McDonnell Douglas Astronautics Company, Naval Studies and Modeling, 5301 Bolsa Avenue, Huntington Beach, CA 92647.

POINT OF CONTACT: Thomas Jacobs, (714) 896-1370, John Butler, (714) 896-4377.

PURPOSE: SCAT models ASW encounters ranging from one-on-one sub vs. ASW sub, ship, or aircraft up to carrier battle force campaigns opposed by eight threat submarines. SCAT is an analysis, research and evaluation tool that can assess competing weapons systems force mix, force tactics, or combat doctrine effectiveness.

DESCRIPTION:

Domain: Full ASW at sea domain (air, sea, and undersea).

Span: Accommodates any ocean environment up to a trans-ocean scenario including subsurface and air.

Environment: Any ocean, and acoustic regime and sea state.

Force Composition: BLUE and RED submarines or ASW forces and C31 up to a carrier battle force or RED equivalent.

Scope of Conflict: Conventional and limited nuclear ASW.

Mission Area: Full ASW including nonacoustics and RED/BLUE pro-sub missions.

Level of Detail of Processes and Entities: Computes the Sonar Equation for any acoustic sensor (e.g. sonobuoy, shipboard or towed sonar, active or passive) through one or two acoustic environments RED and BLUE. Logistics, platform, sensor, and weapons reliability and usage, and basic ASW C31 modeled. Nonacoustics simulated geometrically or with look-up tables.

CONSTRUCTION:

Human Participation: No operator interaction during runs but considerable reactive inputs allowed in scenario presets for RED and BLUE C2 decisions and reactions based on tactical indicators.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo model.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Eight or less threat submarines; one or two acoustic environments; only basic C31; national surveillance sensors treated only by product defined as a Statistical Probability Area.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Converting from FORTRAN 4 to FORTRAN 77 to allow hosting on CRAY, VAX, or super-mini. Adding weapons

effectiveness, and more sophisticated C31 including some data fusion with false targets. Complete by mid-1989.

INPUT: Acoustic and nonacoustic sensor characteristics, oceanographic environmental conditions, RED and BLUE force dispositions, tactics, aircraft allocations and basing, weapons, and responsive tactics.

OUTPUT: Dynamic displays of combat kinematics and statistically analyzed data plots showing measures of effectiveness.

HARDWARE AND SOFTWARE:

Computer:	CYBER, see PLANNED IMPROVEMENTS.
Storage:	About 300,000 CYBER words.
Peripherals:	Color graphics terminal, color plotter, and workstation (Appollo preferred).
Language:	FORTRAN 4 and proprietary discreet event simulation tool-MOSES. See PLANNED IMPROVEMENTS.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Up to 6 man-weeks for complex Battle Force Scenario.

CPU time per Cycle: Depends on data base size and player configuration. Can take from 1/10 second up to 60 seconds for large exercises.

Data Output Analysis: Display of combat kinematics allows verification of unit performance and tactics. Statistical data plots of Monte Carlo analysis show measures of effectiveness for warfare concepts.

Frequency of Use: Varies but is used at least several times per year by those organizations listed below.

Users: Naval Space and Warfare Command (SPAWAR), Naval Air Development Center, Naval Underwater Systems Center, Naval Ocean Systems Center, and McDonnell Douglas.

Comments: Model is continually upgraded based upon customer requirements. Anticipate that all changes required after 6/89 will be managed by a configuration control board.

TITLE: SEABAT - Sea Battle Model

MODEL TYPE: Analysis.

PROPONENT: Studies, Analysis, and Wargaming Division (Code 64), Plans and Policy Directorate, Staff, CINCPACFLT, Pearl Harbor, HI 96860.

POINT OF CONTACT: Dr. Ray Runyan, (808) 474-8443, AV (315) 474-8443.

PURPOSE: SEABAT is an analysis model used for assessing the effects of RED force attacks on BLUE carrier battle forces. It is a research & evaluation tool that is used to assess force capability and requirements, particularly force mix within a carrier battle force and within attacking enemy forces.

DESCRIPTION:
Domain: Sea and air.

Span: Primarily local to the carrier battle force, with some regional activity also included.

Environment: Not considered explicitly. Environment may be reflected by choice of input values for some parameters.

Force Composition: BLUE carrier battle forces consist of a mixture of aircraft carriers, Aegis cruisers, single-ended and double-ended missile ships (CGs, DDGs, and FFGs), ASW combatants (DDs and FFs), and auxiliaries. Aircraft assigned to the battle force include fighters; attack aircraft; and ASW aircraft, including helicopters. RED forces include surface ships; several classes of submarines, including both missile and torpedo shooters; and bombers, jammers, and escort aircraft.

Scope of Conflict: Conventional.

Mission Area: Sea control (AAW, ASW, ASUW)

Level of Detail of Processes and Entities: SEABAT is an expected value model. Thus, ships, submarines, and aircraft are not represented individually. Results are expressed as noninteger numbers of entities. Events are treated sequentially, but specific times are not assigned to events. All entities are subject to attrition.

CONSTRUCTION:
Human Participation: Required for input only. However, once assessment of a series of attacks starts, it may not be interrupted.

Time Processing: Dynamic, event-step for sequential RED attacks on BLUE. Individual attacks are static.

Treatment of Randomness: Deterministic, generates values as functions of expected values.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Geography is not played. The model is essentially a RED-on-BLUE model, with limited capabilities for assessing BLUE-on-RED attacks.

PLANNED IMPROVEMENTS/MODIFICATIONS: Under consideration.

INPUT: BLUE and RED orders of battle, sequence and structure of events (mostly RED attacks), and performance characteristics (probabilities of detection, intercept, and kill, etc.; availability and reliability factors; parameters describing SAM launch cycles; etc.).

OUTPUT: Screen displays of tables showing expected numbers of forces lost and surviving for both RED and BLUE forces. Two levels of output detail are available: summary and expanded. Printed output is optional.

HARDWARE AND SOFTWARE:

Computer:	VAX systems (VMS).
Storage:	82 Kbytes (command file, executables, and typical data).
Peripherals:	Interactive terminal and optional printer.
Language:	VAX FORTRAN 77 (recoded from APL).
Documentation:	(a) Center for Naval Analyses, A Sea Battle Model (U), CNA Research Contribution 373, April 1979, SECRET; (b) Ketron, Inc., "Modification of SEABAT Program for CINCPACFLT's VAX 11/730 System", 21 November 1986, UNCLASSIFIED; and (c) Ketron, Inc., "Status of the SEABAT Model on CINCPACFLT's VAX 11/730 System", 1 April 1988, UNCLASSIFIED. Documents (b) and (c) describe the evolution of SEABAT from a convoy defense model to a battle force defense model.

SECURITY CLASSIFICATION: Secret (unclassified upon removal of data statements).

GENERAL DATA:

Date Implemented: 1979.

Data Base: Default data base provided with model. Data base modifications are made interactively at the beginning of each model run. Time required depends on scope of modifications. Most modifications are made to force and attack structures and can be completed within minutes.

CPU Time per Cycle: Seconds.

Data Output Analysis: Seconds.

Frequency of Use: Many times per year. CINCPACFLT uses SEABAT for its annual Capabilities Assessment, and CINCPAC uses it for analysis and war game BDA. SEABAT is also a supporting model for the CASES module of the Fleet Command Center Battle Management System.

Users: CINCPACFLT, CINCPAC.

Comments: Configuration managed by CINCPACFLT. Releases may be in the form of executable code and data base only.

TITLE: SEAT - Strategic Engagement Analysis Tool

MODEL TYPE: Analysis.

PROPONENT: Los Alamos National Laboratory, A-5, Los Alamos, NM 87544.

POINT OF CONTACT: H. W. Egdorf, A-5 MS-F602, (505) 665-1087.

PURPOSE: SEAT is an AI-based analytic tool used to perform analysis of relocatable target acquisition, attack, and defense. This research and evaluation tool deals with weapons systems, systems effectiveness, force capability and requirements, and combat development.

DESCRIPTION:

Domain: Land and air.

Span: Variable regional areas (primarily Soviet Union).

Environment: A rail network. The projected environment includes a digitized road network, elevation, weather, forestation, and day/night.

Force Composition: BLUE attacker and RED target set.

Scope of Conflict: Conventional nuclear weapons. The projected scope of conflict includes special nuclear weapons and conventional weapon effects.

Mission Area: Target acquisition, detection, attack, and defense. Transportation activities.

Level of Detail of Processes and Entities: The operational tactics for SRTs and BLUE C3 are portrayed as well as the physical characteristics and employment strategies of the target acquisition (sensors) and weapon entities. Entities that participate in an engagement include a RED regiment C3 and RED battalions (each battalion consists of three launchers and command post) in the target subsystem; aircraft, satellites, and df-nets in the target acquisition subsystem; BLUE C3; weapons; BLUE search and attack; and terrain.

The simulation uses an event-driven architecture for observing and queuing sensors, firing weapons, BLUE searching and attacking, and moving targets. The appropriate military command structure of SRTs was also modeled. Targets can fire upon armed reconnaissance units. Targets that have been killed are removed from the simulation and used weapons are also depleted. Parameterized variables support the probability-of-kill attrition determination. If planes have finished their flight plan, they are not used in the simulation until they are ordered on another reconnaissance mission.

CONSTRUCTION:

Human Participation: Required for input scenario specification. Human participation is permissible via module interruptability.

Time Processing: The model is dynamic with both time-step and event-step.

Treatment of Randomness: Has both stochastic and deterministic facets. Stochastic portions use direct computation instead of Monte Carlo techniques. Deterministic portions have no randomness.

Sidedness: Two-sided, asymmetric, event-driven model. Can be used by a single analyst.

LIMITATIONS: Does not model all C3I functions.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Terrain representation will be enhanced to include a road network, weather, elevation, forestation, and day/night. Additional weapons effects, C3 functions, and train generators will be included in future versions.

INPUT: The scenario subsystem is very flexible and provides easy access for analyst to modify scenario data values. Data values include terrain, weapons, movement, attrition tables, and unit characteristics. Changing decision rules requires programmer assistance.

OUTPUT: Full graphics, real-time representation of situation and activities including movement, acquisition, attrition, communication, and logistic data.

HARDWARE AND SOFTWARE:

Computer:	Runs on the Symbolics 36XX computers.
Storage:	.5 Megabytes.
Peripherals:	1 printer.
Language:	LISP, Knowledge Engineering Environment, FORTRAN.
Documentation:	User manual.

SECURITY CLASSIFICATION: Unclassified, but data bases and knowledge bases are classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Terrain data base is time and data intensive. Other data bases are easily constructed. Cognitive aspects of knowledge bases require special planning, programming, and handling.

CPU time per Cycle: Near real-time depending upon analyst desires.

Data Output Analysis: N/A.

Frequency of Use: At Los Alamos several times per year and supports other appropriate organizations in joint and cooperative studies.

Users: Los Alamos National Laboratory.

Comments: A first analysis product developed from an earlier prototype. Design of the tool provides the capability to perform analysis on many other applications. Therefore future simulations can be run representing buried targets or a new type of weapon in addition to the currently defined mobile system (SS-24s). The menu-driven interface allows for future integration of software modules as they become available.

TITLE: SEES 1.1 - Security Exercise Evaluation Simulation Version 1.1

MODEL TYPE: Analysis and training.

PROPONENT: Conflict Simulation Laboratory, Lawrence Livermore National Laboratory, P.O. Box 808 L-315, Livermore, CA 94550.

POINT OF CONTACT: Lauri A. Dobbs, (415) 423-8590, FTS 543-8590.

PURPOSE: SEES simulates close combat in an urban terrain. For analysis, SEES provides a tool to assess the vulnerability of sensitive urban areas, aids in the evaluation of proposed modifications to security safeguards, and assists in safeguard resource cost and risk analysis. SEES can also be used for training in command, control, communications, and tactics.

DESCRIPTION:
Domain: Land.

Span: Can be used with force sizes from squad to platoon level at item system resolution.

Environment: Digitized terrain from DMA or other data bases for elevation with cultural features overlay. One story buildings (interiors and exteriors), fences, and roads are explicitly modeled. Daytime and limited nighttime play are modeled. Weather can be changed but remains constant during the simulation.

Force Composition: Dismounted troops and their associated vehicles; RED and BLUE sides.

Scope of Conflict: Unconventional with limited chemical.

Mission Area: Close combat in urban terrain.

Level of Detail of Processes and Entities: Up to 500 item systems per side. Acquisition and attrition are done at the item system level. Attrition is stochastic. Logistics and resupply can be played.

CONSTRUCTION:
Human Participation: SEES can be used with or without human participation. With human participation, up to 16 players can freely interact with their units during the simulation. All planning functions are performed by the human player. Without human interaction, a preplanned scenario can be played in batch mode. The model is interruptable on a fixed time step and then reinstated in either mode.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Because SEES 1.1 was developed from the Janus model, human item systems are modeled simplistically. Only one-story buildings are modeled. Currently, artillery has no effect on the buildings, fences, and roads.

PLANNED IMPROVEMENTS AND MODIFICATIONS: SEES 2.0, which is currently under development, will have a detailed model of human item systems including strength, endurance, running speeds, and breaching capabilities. The terrain modeled will include multi-story buildings and features such as roads, vegetation areas, and rivers affecting line-of-sight and movement of humans.

INPUT: Terrain file, pH/pK file, user-defined symbol file, and scenario file that contains all item systems characteristics, coefficients and parameters used by the algorithms in the model, and orders and plans.

OUTPUT: Players sitting at graphic workstation displays, which are continually updated during the simulation, can request various status reports at any time. Status and event data may be written to disks during the simulation for postprocessing.

HARDWARE AND SOFTWARE:

Computer:	Any VAX computer, from VAXstation 2000 through VAX 8800. Uses VMS 5.0 operating system.
Storage:	Minimum requirement: 50,000 blocks.
Peripherals:	Minimum requirement: one Tektronix 4225 workstation (two required for 2-sided simulations) with one graph tablet, one VT100 or compatible terminal. Can expand up to eight workstations with two graph tablets each. Printer is not required but there are many printed reports available.
Language:	VAX FORTRAN (SEES 2.0 will use VAX Ada).
Documentation:	SEES Users Manual and SEES Algorithms Document.

SECURITY CLASSIFICATION: Unclassified, but data bases may be classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Creating new data bases may take from one-half man-day up to one man-week depending on the size and complexity.

CPU time per Cycle: Scenario-dependent. Smaller scenarios will run 10 times as fast real time, but can be slowed to real time in order to give the players time to react.

Data Output Analysis: The user determines which status and event data is to be output to disk. Some reports can be printed, while the rest may be read into a relational data base management system for postprocessing.

Frequency of Use: Currently used three to four times per year to assist in the preparation of force-on-force exercises.

Users: Lawrence Livermore National Laboratory.

Comments: SEES 1.1 has been developed and managed by Lawrence Livermore National Laboratory. Installations are done under site-specific MOAs at government-approved sites. Source files are not distributed to users.

TITLE: SFEM - Space Forces Engagement Model

MODEL TYPE: Analysis (but could be used for training).

PROPONENT: HQ Air Force Space Command, DCS/PLANS, Directorate of Plans and Programs.

POINT OF CONTACT: Dr. A. W. Bevan, (719) 554-3802, AV 692-3802.

PURPOSE: This model analyzes the effectiveness of proposed space control system architectures against a space attack with emphasis on battle management and command and control. Surveillance and weapon system deployment options can also be analyzed, and component-level "what if" questions can be investigated. The simulator can also be used as a training tool for understanding a space control system architecture.

DESCRIPTION:

Domain: Land, sea, air, and space.

Span: Global space defense.

Environment Models time; illumination of satellites for optical sensor viewing; day and night conditions at optical sensor; and earth, sun and moon background effects on optical and radar sensor response.

Force Composition: Mix of ground-based and space-based kinetic energy and directed energy weapons for space defense. Basing can be fixed ground site, ship, airplane, missile, or satellite.

Scope of Conflict: Weapons are conventional or nuclear; RED or BLUE. Weapons, sensors, battle management/command and control, and communications are defined in a data base using a preprocessor.

Mission Area: Space control and space defense.

Level of Detail of Processes and Entities: Command and control/battle management modeled using posts, alert levels, engagement rules, threat assessment rules, and weapon selection and employment rules that are defined through the data base. Weapons and sensors are modeled at the component level. Communications are connectivity/line-of-sight only.

CONSTRUCTION:

Human Participation: Required to define rules in the data base using a preprocessor. No intervention during the simulation.

Time Processing: Dynamic, event-driven model.

Treatment of Randomness: Model can run in either a stochastic or a deterministic mode. Stochastic is Monte Carlo. Deterministic uses the mean values of distributions.

Sidedness: Phase I of the model is one sided; the side can be either RED or BLUE. Phase II of the model development will make the model two sided.

LIMITATIONS: Does not model defense of ground assets.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Phase II of the model development will make the model two sided, enhance the modeling of communications, and include more weapon types. Graphics enhancements are also planned.

INPUT: A preprocessor is used to place into a data base object, vessel, and satellite locations; assign functions to objects; define sensor and weapon characteristics; define connectivity between functions; and to define battle management/command and control configurations and rules. Simulation controls are also set through the preprocessor.

OUTPUT: Simulation events are logged to an output event file and are processed by a postprocessor.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a VAX computer with a VMS operating system.
Storage:	6 megabytes needed for data base.
Peripherals:	Minimum requirements: 1 printer, 1 VT1XX terminal.
Language:	VAX FORTRAN and DCL. Datatrieve and Common Data Dictionary required for postprocessor.
Documentation:	User's manual, algorithm descriptions, and production specifications are available.

SECURITY CLASSIFICATION: Code can be either unclassified or secret.

GENERAL DATA:

Date Implemented: 1989.

Data Base: Population of a large data base could take half a man-year.

CPU time per Cycle: Depends upon data base size. Nominal time to run could be on the order of hours.

Data Output Analysis: VAX Datatrieve used as postprocessor of log output file.

Frequency of Use: Monthly.

Users: Model still in testing phase so the Air Force Space Command is the only user.

Comments: Phase I of model still in testing phase and will be available for use approximately March 1989.

TITLE: SHIPDAM

MODEL TYPE: Training and education.

PROPONENT: Wargaming Department, Naval War College.

POINT OF CONTACT: Micromodels Manager, (401) 841-3276, AV 948-3273.

PURPOSE: SHIPDAM models ship damage caused by weapons hits. It is designed to support battle damage assessment in conjunction with larger war games or other micromodels.

DESCRIPTION:
Domain: Sea.

Span: Local.

Environment: N/A.

Force Composition: Individual ship, enemy antiship weapons.

Scope of Conflict: Conventional antiship weapons.

Mission Area: N/A.

Level of Detail of Processes and Entities: User defines target ship, type and number of impacting weapons, and azimuth of weapon approach.

CONSTRUCTION:
Human Participation: Required for initial inputs only.

Time Processing: Closed form.

Treatment of Randomness: Outcomes stochastically based on direct computation of probabilities, with Monte Carlo determination of result.

Sidedness: N/A.

LIMITATIONS: Can only be run for ship classes for which data sets have been constructed by David Taylor Research Center.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Additional data sets, incorporation of personnel casualties.

INPUT: Target ship, type and number of impacting weapons, and azimuth of weapon approach.

OUTPUT: Data files containing exact burst point location for each hit, up/down status for ship components and systems, and hit-by-hit report.

HARDWARE AND SOFTWARE:
Computer: IBM-compatible PC with 512K RAM.
Storage: N/A.

Peripherals: N/A.
Language: "C."
Documentation: User's manual, source code.

SECURITY CLASSIFICATION: Unclassified, but data bases are classified.

GENERAL DATA:
Date Implemented: 1988.

Data Base: 10 minutes.

CPU time per Cycle: 20 seconds.

Data Output Analysis: N/A.

Frequency of Use: Several times per year.

Users: Wargaming Department, Naval War College.

Comments: SHIPDAM is called by the Surface-Air Battle model. The original model was designed by the David Taylor Naval Ship Research and Design Center and is based on the mainframe-based Ship Vulnerability Model at DTNSRDC.

TITLE: SIDAC - Single Integrated Damage Analysis Capability

MODEL TYPE: Analysis.

PROPONENT: Vulnerability Analysis Branch (C312), Joint Data Systems Support Center (JDSSC), The Pentagon, Washington, DC 20301-7010.

POINT OF CONTACT: Ralph Mason, (202) 697-7421, AV 227-7421.

PURPOSE: SIDAC is a standard computer system used for assessing the response of a nation or nations to a simulated nuclear attack. It has a generalized capability designed to give a high degree of flexibility in fulfilling the nuclear damage assessment requirement for a wide range of users.

DESCRIPTION:

Domain: Assessment points on the earth's surface.

Span: Global.

Environment: Weather--upper air winds.

Force Composition: All nuclear weapons.

Scope of Conflict: Nuclear weapons (RED and BLUE).

Mission Area: Strategic nuclear.

Level of Detail of Processes and Entities: Individual assessment points or areas can be used. Aggregated results can also be obtained at user's request. Prompt damage by DIA's Physical Vulnerability methodology and fallout by WSEG or DNAF-1 or SEER (user's choice).

CONSTRUCTION:

Human Participation: Not permitted during model execution but provision is made to "EXIT" to user programs at several locations. User participation is required during definition phase.

Time Processing: Fallout values are time dependent.

Treatment of Randomness: Assessment values are normally deterministic (expected value). However, special output processors have been developed to provide stochastic results using Monte Carlo procedures.

Sidedness: Not appropriate to a nuclear damage assessment system.

LIMITATIONS: Knowledgeable users are required to set up the first runs for new applications that differ from the norm. Assessment points must reside on the earth's surface.

PLANNED IMPROVEMENTS AND MODIFICATIONS: System is updated at least once a year to include user-requested improvements and to keep the system state of the art in nuclear damage assessment methodology.

INPUT: Weapons, assessment points (targets), winds, user controls, and output programs.

OUTPUT: Hard copy printouts, detailed and summary processing, error files, and files for plotting.

HARDWARE AND SOFTWARE:

Computer:	IBM 44341/3033, HIS 6080, and DG 10000.
Storage:	Storage requirements are variable depending on application; on HIS the main requirement is for 48K to load the H*.
Peripherals:	Suggested peripherals: one tape drive, one printer, one disk storage device, and one terminal. Plotter required for plots.
Language:	N/A.
Documentation:	HIS 6000, SPM FD 7-73; SCM 67-79; SMP PT 7-73's; TM 15-80; TM 91-84; SPM RT 7-75; TM 154-81; TM 15-80; TM 182-79; IBM Version - mini users manual.

SECURITY CLASSIFICATION: Confidential without user data files.

GENERAL DATA:

Date Implemented: HIS: 1974.
IBM: 1983.

Data Base: From hours to months depending on use of standard data bases.

CPU time per Cycle: From several minutes to hours depending on the size and complexity of the run and also on the computer executed.

Data Output Analysis: Variable.

Frequency of Use: Daily.

Users: The Joint Staff, OSD, JSTPS, NCS, and DIA.

Comments: Very flexible system in both input and output.

TITLE: SIM II Naval Warfare Engagement Simulation

MODEL TYPE: Analysis.

PROPONENT: Naval Underwater Systems Center, New London, CT 06320.

POINT OF CONTACT: Dr. Wilhelm H. Bortels (Code 61), (203) 440-4242.

PURPOSE: SIM II is a research and evaluation tool used for ASW weapons system studies. The study results express system effectiveness of engagements against projected threat submarines.

DESCRIPTION:

Domain: Sea, air, and undersea, with emphasis on undersea.

Span: Local engagements that may be many-on-many.

Environment: Acoustic propagation loss, reverberation levels, and primary arrival angles for multiple frequencies and source-receiver depth combinations; ambient shipping and sea state noise; and homogeneous environment for single simulation run.

Force Composition: ASW units from individual ships through a complete battle force oppose one or more submarines.

Scope of Conflict: Conventional and nuclear ASW weapons.

Mission Area: All offensive or defensive ASW operations.

Level of Detail of Processes and Entities: Entities are modeled at the level of individual ships, aircraft, weapons, countermeasures, and sonobuoys. Processes modeled between ships include detection, classification, target motion analysis, and communications. Attrition is modeled when weapons hit targets.

CONSTRUCTION:

Human Participation: Not permitted. Model does not include an adaptive tactics language that recognizes significant events or allows the analyst to specify an appropriate response.

Time Processing: Dynamic, variable time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Limited treatment of air and surface weapons.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Ongoing program of developing algorithms for addressing submarine sensor, combat system, and weapon technologies. Current focus includes models, human interactive version, and analyst productivity tools.

INPUT: The acoustic inputs include radiated noise, sonar characteristics, and environment. The scenario initialization is established through geometries that can include random components. Ship tactics are input to provide tactic selection logic and implementation. Weapons, countermeasures, and sonobuoys are input as ships with appropriate characteristics as tactics.

OUTPUT: Detailed output file with data at points selected by the analyst. Postprocessors allow geometric display of engagement with detailed commentary, computation and display of metrics, and averaging over multiple scenarios with statistical analysis.

HARDWARE AND SOFTWARE:

Computer (OS): Currently operational on VAX, CRAY, UNIVAC (1100), CDC CYBER, and SUN workstation. Can be adapted to any 32-bit (or larger) computer. Insensitive to operating system, except that many analyst productivity tools are specific to the VAX VMS architecture.

Storage: Eighty-five thousand 36-bit words for 4 ships, 4 types, and 20 sonars. Version size increases significantly for larger simulations and decreases slightly for 2-ship simulations with no weapons.

Peripherals: No specific requirements, but the analyst productivity tools use the VAX VT-240 VDT.

Language: ASCII Standard FORTRAN 77.

Documentation: SIM II: A Computer Program for the Simulation of Naval Engagements, January 1985. Two volumes, periodic changes.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: April 1974.

Data Base: About one week for scenarios from an established data base.

CPU time per Cycle: Runs at approximately 1,000 times real time for single ship engagements on the VAX. A typical run of 100 simulated engagements runs in about one hour.

Data Output Analysis: Varies with the extent of analysis. Planned outputs are available at completion of the run. Extensive analysis with analyst productivity tools requires one to four hours.

Frequency of Use: 15 to 20 major studies per year; daily program execution.

Users: NUSC, David Tyler Research Center, Naval Coastal Systems Center, Center for Naval Analysis, Commander Submarine Development Squadron TWELVE.

Comments: Configuration and control documentation maintained by NUSC Code 61. Source code releasable to government agencies.

TITLE: SINBAC - Systems for Integrated Nuclear Battle Analysis Calculus

MODEL TYPE: Strategic nuclear analysis.

PROPONENT: Force Structure, Resource, and Assessment Directorate (J-8), The Joint Staff, The Pentagon, Room 1D937, Washington, DC 20318-8000.

POINT OF CONTACT: Mr. Dale Peters, (202) 695-0859, AV 225-0859.

PURPOSE: SINBAC develops RISOP or other detailed nuclear plans and war games a SIOP/RISOP or similar exchange.

DESCRIPTION:

Domain: Land, sea, air, and space.

Span: Global.

Environment: Geographic coordinates, broad country outlines.

Force Composition: Missile silos, mobile launcher, SSBN, SSN, and bomber; plus for war games, defensive aircraft, radars, SAMs, and ABM.

Scope of Conflict: Nuclear.

Mission Area: Strategic forces, intermediate nuclear forces.

Level of Detail of Processes and Entities: Individual nuclear weapons, i.e., each missile RV, SLCM, SRAM, ALCM, and bomb, with their sorties (bomber rcutes and missile footprints). Timing to the second. Targets are individual installations.

CONSTRUCTION:

Human Participation: Required for decisions as plan is built.

Time Processing: Plan is static. War game is dynamic, time-step, and event-step.

Treatment of Randomness: Plan is deterministc, using expected value. War game is stochastic, Monte Carlo.

Sidedness: Two-sided. Plan is asymmetric with one side non-reactive. War game is symmetric.

LIMITATIONS: Does not model fratricide although it uses timing for a silo attack based o off-line analysis. Other modeling less detailed than desired, such as cruise missiles, SDI, and other defensive systems, refueling and relocatable systems movement.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Detailed cruise missile routing, relocatable targets and weapons movement, SDI modeling, fratricide/deconfliction, improved interceptor modeling, refueling modeling, flyout through nuclear effect modeling, plus technical improvement such as knowledge-based algorithm, parallel processing, interfaces to other models, improved user interface, and interactive graphics.

INPUT: Detailed weapon orders of battle and characteristics, both offensive and defensive; detailed target bases; and controls over the allocation and war game.

OUTPUT: Hardcopy reports and magnetic tapes summarizing data and results such as damage expectancy, attack timing, weapon destruction by defenses, residual weapons, and casualties.

HARDWARE AND SOFTWARE:

Computer:	VAX 8700 (VMS).
Storage:	Extensive disk storage needed, covers multiple drives.
Peripherals:	VT-100-type terminals, printer.
Language.	VAX FORTRAN, DEC FMS, and DATATRIEVE.
Documentation:	Data base, user's, and maintenance manuals.

SECURITY CLASSIFICATION: Model itself is unclassified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: RISOP and war game 6 months each.

CPU time per Cycle: RISOP and war games 500 hours each.

Data Output Analysis: RISOP and war games 2 months each.

Frequency of Use: Annual cycle/continuous use.

Users: J-8.

Comments: Main operation on SIOP-cleared VAX, operational for studies on J-8 TOP SECRET VAX, working to maintain configured code on an unclassified VAX.

TITLE: SITAP - Simulation for Transportation Analysis and Planning

MODEL TYPE: Analysis.

PROPONENT: Logistics Directorate, The Joint Staff, The Pentagon, Washington, DC.

POINT OF CONTACT: Nancy Hardy, (202) 694-8026, AV 224-8026.

PURPOSE: SITAP provides the user with an insight into the operational behavior of a given inter/intratheater transportation system through simulation modeling.

DESCRIPTION:

Domain: Land, air, and sea.

Span: Accommodates any theater depending on data base.

Environment: N/A.

Force Composition: Joint and combined forces.

Scope of Conflict: Conventional.

Mission Area: Conventional mission.

Level of Detail of Processes and Entities: Individual aircraft and ships.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step and event-step.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Scenario needs to be generated by hand; necessary data not always available.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Structure code.

INPUT: MORSA Data Base System produces movement requirements form OPLAN TPFDDs and JPAM data bases.

OUTPUT: Provides detailed reports on simulation activity and produces tabular reports and graphic displays.

HARDWARE AND SOFTWARE:

Computer: Runs on the VAX under VMS and the IBM under TSO.

Storage: 75 MB.

Peripherals: Minimum requirements: one printer and one terminal.

Language: FORTRAN.
Documentation: SITAP manual.

SECURITY CLASSIFICATION: Model is unclassified, but data bases are often classified.

GENERAL DATA:
Date Implemented: 1968.

Data Base: 5 to 10 days.

CPU time per Cycle: Size dependent (from 5 to 40 minutes of CPU time).

Data Output Analysis: Graphic displays and tabular reports produced by postprocessor aid in analysis.

Frequency of Use: N/A.

Users: NATO, SHAPE, Naval War College, Australian Ministry of Defense, and EUCOM.

Comments: N/A.

TITLE: SLAVE - Simple Lethality and Vulnerability Estimator

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Ballistic Research Laboratory, Vulnerability Lethality Division (SLCRR-VL), Aberdeen Proving Ground, MD 21005.

POINT OF CONTACT: James P. Billingsley, (205) 876-5210, AV 746-5210.

PURPOSE: SLAVE is a simplified vulnerability/lethality (V/L) prediction digital computer code that employs critical component kill (or damage) methodology to assess a target's loss of combat effectiveness when subjected to attack. SLAVE's primary output is a probability of kill (pK) grid covering the target's projected area normal to the attack direction. When properly processed and weighted with respect to system accuracy and tactical parameters, the final average pKs may be employed.

DESCRIPTION:

Domain: Land, sea, air, and space targets can be assessed.

Span: Local (on or inside the target).

Environment: Depends on the domain and how the attacking weapon system effects are simulated.

Force Composition: Generally one-on-one endgame; for example, one weapon system vs. a nonretaliating target.

Scope of Conflict: SLAVE has options to simulate shaped charge and kinetic energy weapons.

Mission Area: Generic; SLAVE is not a war game simulation code.

Level of Detail of Processes and Entities: SLAVE essentially models the lethality (pK) of one weapon system vs. a single, nonretaliating target. SLAVE is a simplified version of the USABRL vulnerability analysis for surface targets code. It assesses the damage to individual critical components along the main shotline and the spall fragment shotlines. These are combined to yield an overall damage assessment (pK) for that particular grid cell or area. This is done for each of the grid areas that have a sum that is the projected area of the target. Component information along each shotline (main penetrator or spall fragment) is supplied for each grid cell (area) by a geometric code. The warhead simulation input to SLAVE determines the extent of penetration along the primary and spall fragment shotlines. Consequently, the level of detail may vary considerably, depending on the number and detail of the components in the target model geometry.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Penetration or damage is not time dependent. However, under certain circumstances, time could be incorporated as a variable with appropriate modifications to the code.

Treatment of Randomness: A certain degree of randomness is implicitly inherent in the warhead simulation and component damage assessment inputs. Explicit randomness could be incorporated via input or code modifications. The output is basically deterministic for a given input.

Sidedness: Two-sided, asymmetric.

LIMITATIONS: Generally only one target and one weapon system are simulated. However, if the required input for the warhead simulation or component damage assessment is not available, the input must be assimilated from theory or experimental data.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Prior modifications to the basic SLAVE code include alterations so that canted warhead shotline data could be processed correctly. Future modifications for the MICOM versions of SLAVE should be the modeling of explosively formed penetrator warhead penetrations, spall, and damage. A directed energy beam effect model should also be incorporated.

INPUT: Warhead and target penetration information and component damage assessment information.

OUTPUT: The basic output is a table of individual pKs corresponding to each individual grid area of cell. This is commonly called pK grid data and can be postprocessed in various ways. Usually the pK grid data is processed, via a weight code, to properly account for system endgame accuracy. These final weighted values of pK are entered into the war game simulation codes.

HARDWARE AND SOFTWARE:

Computer:	HP 9000 series with a UNIX operating system.
Storage:	Usually no problem.
Peripherals:	1 printer and 1 graphics unit.
Language:	FORTRAN.
Documentation:	ARBRL-TR-02282, ARBRL-TR-02333, and ARBRL-MR-02899.

SECURITY CLASSIFICATION: The basic SLAVE code is unclassified, but certain modifications or data input may be classified.

GENERAL DATA:

Date Implemented: 1979.

Data Base: Appropriate data input for certain weapon system and target combinations may be difficult to acquire and formulate.

CPU time per Cycle: Normally less than one minute.

Data Output Analysis: See output comments above.

Frequency of Use: Approximately twice per year by USAMICOM.

Users: USAMICOM and USABRL.

Comments: SLAVE has proven to be a very useful and versatile V/L analysis tool.

TITLE: SLIC - A Simple Low-Intensity Conflict Assesment Model

MODEL TYPE: Analysis.

PROPONENT: Dr. Daniel Wu, DCA/JDSSC/C314, The Pentagon, Washington, DC 20301-7010.

POINT OF CONTACT: Dr. Daniel Wu, (202) 695-0025, AV 225-0025.

PURPOSE: The model yields an overview of comparative or relative military strength, economic condition, popular support, and political stability in terms of aggregated indicators of low-intensity conflict.

DESCRIPTION:

Domain: Strategic assessment.

Span: Single country.

Environment: N/A.

Force Composition: Government vs. insurgent.

Scope of Conflict: Low intensity.

Mission Area: Special mission.

Level of Detail of Processes and Entities: Highly aggregated.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic.

Treatment of Randomness: Little.

Sidedness: Government vs. insurgent.

LIMITATIONS: Highly aggregated.

PLANNED IMPROVEMENTS AND MODIFICATIONS: More research is needed.

INPUT: Moderate country data.

OUTPUT: Dynamic trends (graphics or tabulation).

HARDWARE AND SOFTWARE:

Computer:	PC.
Storage:	Minimum.
Peripherals:	One printer.
Language:	Professional DYNAMO.
Documentation:	A paper.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Moderate data base for the country of interest.

CPU time per Cycle: Minimum.

Data Output Analysis: Trend projection.

Frequency of Use: Research model.

Users: To be established.

Comments: This is a simple model for high-level policy makers.

TITLE: SNAP - Strategic Nuclear Attack Planning

MODEL TYPE: Analysis.

PROPONENT: Strategic Systems Analysis Branch (C314), JDSSC, DCA, The Pentagon, Washington, DC 20318-7010.

POINT OF CONTACT: Dr. Dan Wu and Mr. Khoa Nguyen, (202) 695-0025, AV 225-0025.

PURPOSE: SNAP was developed to assist military planners in solving problems involving a strategic nuclear attack plan on potential enemy resources. The number and allocations of the DGZs of the allocated weapons are determined by user-specified parameters. The allocation technique, which uses military judgment and experience for the selection of weapons, targets, and allocation parameters, provides considerable flexibility to the user of the system.

DESCRIPTION:

Domain: Up to 80 nuclear weapons systems from up to 80 launch areas.

Span: Single-sided strategic or theater nuclear level.

Environment: Prompt nuclear blast effect.

Force Composition: RED offensive threat and BLUE target base (or vice versa).

Scope of Conflict: Strategic offensive nuclear exchange analysis.

Mission Area: Strategic conflict.

Level of Detail of Processes and Entities: SNAP is capable of allocating a given mixed weapon arsenal with or without range restrictions to a given target data base of the strategic or theater nuclear level. The model fulfills planning restrictions and requirements such as heights of burst (fallout free, specified, optimal), minimum kill per weapon, number of weapons per DGZ, population avoidance restrictions, and cross targeting of time-phased attacks using circular or polygon range constraints.

CONSTRUCTION:

Human Participation: SNAP can accept military judgment and experience in the selection of objectives, weapons, and targets. The planner may change these inputs to the system as the results of previous selections for an attack plan are assessed.

Time Processing: Static allocation of weapons to targets over time.

Treatment of Randomness: Not directly used (a damage expectancy model).

Sidedness: One-sided.

LIMITATIONS: Model measures prompt blast effects only. Code is not well documented.

PLANNED IMPROVEMENTS AND MODIFICATIONS: SNAP is undergoing enhancement through JDSSC. The mode is being enhanced, modified, and recoded. The improved SNAP will be renamed N-SNAP. Estimated delivery of N-SNAP is November 1989.

INPUT: JRAD (336 character) target data base and user-supplied weapon, launcher, and wave-by-wave scenario files.

OUTPUT: Several dozen reports including DGZ/strike file, cumulative weapon report, and target category report. Graphics reports include bar and pie charts and maps.

HARDWARE AND SOFTWARE:

Computer:	VAX (11/780 or compatible) with VMS 4.0.
Storage:	700 blocks to store executable image; 300 blocks data files; 30 million bytes virtual memory (60,000 pages).
Peripherals:	VT 200 Tektronics terminals; line/laser printer for report review.
Language:	40,000 lines FORTRAN, DISSPLA, DCL.
Documentation:	User's guide.

SECURITY CLASSIFICATION: Unclassified without input data; secret with input data.

GENERAL DATA:

Date Implemented: 1977.

Data Base: Currently supported by user-generated flat files. Separate effort underway to support the files with INGRES data base calls.

CPU time per Cycle: 10-30 minutes (depending on size of target base).

Data Output Analysis: N/A.

Frequency of Use: Used daily.

Users: The Joint Staff/J-8 until delivery of N-SNAP in November 1989.

Comments: None.

TITLE: SODSIM - Strategic Offense/Defense Simulation

MODEL TYPE: Analysis.

PROPONENT: Strategic Defense Initiative Organization (SDIO), The Pentagon, Washington, DC 20301-7100.

POINT OF CONTACT: MAJ Frank Maressa, (202) 693-1608.

PURPOSE: SODSIM is a research and evaluation model developed to provide maximum flexibility and growth potential for analyzing the end-to-end interactions of force exchanges involving RED and BLUE offensive and defensive forces. SODSIM uses inputs representing RED and BLUE offensive and defensive weapon system characteristics to include multi-tiered space-based systems, probes, and airborne platforms. Attack timing, battle management, firing doctrine, and communications options among defense elements can be specified.

SODSIM handles RED and BLUE multi-wave attacks to include targeting offenses and defenses on both sides. The simulation creates a trajectory for each individual attacker and does not aggregate threat objects into threat tubes. There can be at least one action subroutine for each defender and attacker combination.

DESCRIPTION:

Domain: Land, air, space, undersea, and any combinations of these domains.

Span: Full spectrum from individual to global offensive and defensive force elements.

Environment: Time of day as determined by sun's position during scenario.

Force Composition: RED and BLUE strategic offensive and defensive forces.

Scope of Conflict: Strategic nuclear exchange.

Mission Area: Strategic nuclear exchange.

Level of Detail of Processes and Entities: Individual attackers and individual defenders.

CONSTRUCTION:

Human Participation: Required for preparation of input data and decisions related to weapon system operational concepts.

Time Processing: Dynamic, discrete, event-driven, time-oriented simulation.

Treatment of Randomness: Stochastic treatment of all events based on input probabilities or direct computation of probabilities.

Sidedness: Two-sided, asymmetric, reactive.

LIMITATIONS: Does not model sea warfare.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The simulator design will accommodate air-breathing attackers and defenders, and work is being planned to integrate RED and BLUE air-breathing offensive and defensive forces into the simulation.

INPUT: RED and BLUE attack scenarios, weapon system operational performance parameters, and battle management/C3 concepts.

OUTPUT: Raw and statistically analyzed data.

HARDWARE AND SOFTWARE:

Computer:	Cray 1, Cray XMP, Cray 2, PC-AT, VAX.
Storage:	5 to 500 MB depending on size of scenario.
Peripherals:	Video terminal, printer, or both.
Language:	FORTRAN 77.
Documentation:	SODSIM User's Manual and SODSIM Technical Reference Manual.

SECURITY CLASSIFICATION: Source code is unclassified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: One-half to two days required for initial preparation.

CPU time per Cycle: Less than one hour for very large scenario.

Data Output Analysis: Postprocessor available in utilities library to augment statistics normally available from a run.

Frequency of Use: Daily use.

Users: Riverside Research Institute, Los Alamos National Laboratory, the Joint Staff, and Blime, Incorporated.

Comments: Questions concerning SODSIM should be referred to Blime, Incorporated, 1600 Duke Street, Suite 430, Alexandria, VA 22314; (703) 549-5787.

TITLE: SOJ - Stand-Off Jamming

MODEL TYPE: Analysis.

PROPONENT: Studies and Analysis Directorate, The Air Force Electronic Warfare Center, ESC, San Antonio, TX 78243-5000.

POINT OF CONTACT: Rick Salinas or Ted Trakas, (512) 925-2391, AV 945-2391.

PURPOSE: Evaluate the ECM effectiveness of a stand-off jammer screening a penetrating aircraft against ground-based radars.

DESCRIPTION:

Domain: Land and air.

Span: Individual scenario.

Environment: Optimum environmental conditions.

Force Composition: N/A (a single SOJ against a single threat radar.)

Scope of Conflict: Conventional (RED, BLUE, GRAY).

Mission Area: Threat radar suppression.

Level of Detail of Processes and Entities: The model calculates the radar detection range of a penetrator with no ECM from the SOJ. Then it computes the jammer burn-through range (i.e., the range from the threat where jamming is no longer effective). The model is based on the fundamental range and burn-through equations from radar theory and incorporates a smooth, round earth, line-of-sight concept.

CONSTRUCTION:

Human Participation: Required for processing (data input).

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Atmospheric attenuation, ground clutter, multi-path, ground reflection and terrain masking are not included.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Scenario, aircraft, jammer, and threat data bases.

OUTPUT: Produces a computer screen display and a printout of the results.

HARDWARE AND SOFTWARE:

Computer: Designed to run on a VAX computer with a VMS operating system.

Storage: Approximately 62,000 blocks (31 megabytes) of memory is required for the executable code and the data bases.

Peripherals: A Tektronix 4200 series (graphics) terminal and a Tektronix 4692 series color graphics copier.

Language: FORTRAN 77.

Documentation: None.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: The parametric data used in all of the data bases is obtained from our unit's electronic combat data library. The library receives its information from national assets as well as from testing facilities.

CPU time per Cycle: 1-2 minutes.

Data Output Analysis: The output analysis is based on a single percent area coverage number. A dual purpose envelope illustrates radar detection and burn-through range is displayed graphically upon request. The model begins each simulation with the first point of penetrator detection at 0 degrees bearing from the radar site. The model then steps the penetrator radially towards the radar in 1 kilometer increments until burn-through is achieved. This procedure is then repeated for the next 359 degrees around the radar site in 1 degree increments. The final number reflects the percent reduction in detection area achieved by jamming. The computer model compares the radar area of coverage before and after jamming.

Frequency of Use: Several times a year depending on tasking requirements.

Users: AFEWC/SATR.

Comments: None.

TITLE: SOTACA - State of the Art Contingency Analysis

MODEL TYPE: Analysis.

PROPONENT: Joint Warfare Center, Hurlburt Field, FL 32544.

POINT OF CONTACT: Joint Warfare Center, (904) 844-6926, AV 579-6926.

PURPOSE: SOTACA is an operations support tool (decision aid) used in the time-sensitive planning process by planners of the unified and specified commands to quickly analyze and compare alternative courses of action. The planner can assess feasibility, suitability, acceptability and completeness of the varied courses of action using factors such as force attrition, movement rate to an objective area or in accomplishing the mission, and fuel and ammunition expenditures as measures of effectiveness.

DESCRIPTION:

Domain: The operating area is defined by the user.

Span: Can be scaled for global, theater, regional, local, or individual applications.

Environment: Using a network of nodes and links, the user sets mobility and terrain parameters to define the operating environment.

Force Composition: Any mix of forces can be portrayed by the model , including combined forces, joint forces, or separate component forces.

Scope of Conflict: Any category of weapon or weapon types for friendly and enemy forces can be considered, including conventional, chemical-biological-nuclear, special, rear-area, and political.

Mission Area: Any combination of weapons or procedures mission can be modeled.

Level of Detail of Processes and Entities: Entity: The lowest entity modeled may be a single warrior, weapon, or task force. Processes: Confrontation between opposing forces affects the defined entities that are assigned specific attributes and missions.

CONSTRUCTION:

Human Participation: Interactive with human participation required for decisions and processes.

Time Processing: Dynamic, time-step.

Treatment of Randomness: The model is basically deterministic.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Because SOTACA is a first cut, low-resolution model, the level of detail provides extremely rough calculations for the measures of effectiveness, which limits course of action assessment to comparative

analysis techniques. In addition, entity (weapon) attributes, such as power or vulnerability, are defined by relative comparisons based on user experience or user-known limitations of the entity, not necessarily by quantifiable characteristics, such as rate of fire, kill probabilities, or other engineering specifications. Confrontations or conflict between opposing forces occurs only at the user defined nodes of the generated network, a limitation that can be overcome by various gaming techniques.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The above noted limitations are subjects of continued research to improve the current model.

INPUT: The user enters a listing of the available forces, organizes those forces into employable task forces, defines their power and vulnerability attributes, establishes logistic factors, defines the operating area, and defines the employment plan of all forces in the operating area.

OUTPUT: Computer printouts or screen displays that contain raw data of force attrition, ammunition and fuel usage, time elapsed, unit locations, and other data used for analysis.

HARDWARE AND SOFTWARE:

Computer:	VAX 11-780, 8600/8700, or MicroVAX with Techtronics VT100 or 4107/4109/4207/4209 terminal.
Storage:	Minimum storage required (WITHOUT DATA) is 120,000 disk blocks (512 bytes/block).
Peripherals:	A printer for hard copy outputs is required.
Language:	The model is designed in FORTRAN.
Documentation:	A user's manual for the current version is available as well as documentation describing the mathematical methodology used by the model.

SECURITY CLASSIFICATION: Unclassified, but the user data base is classified.

GENERAL DATA:

Date Implemented: 1985

Data Base: 48 hours or less.

CPU time per Cycle: 8 hours of real time can be replicated by the model in 3 seconds of CPU time.

Data Output Analysis: Several hours.

Frequency of Use: As required.

Users: CINCs of unified and specified commands.

Comments: Times stated to for data base input and data output analysis are entirely dependent on level of detail and quantity of data. SOTACA has been designed to compare multiple courses of action to determine differences between different employment schemes. This allows a planning staff to consider various options in determining the most effective employment strategy of assigned forces.

TITLE: Soviet Troop Control Air Model

MODEL TYPE: Training and education.

PROPONENT: Air Force Wargaming Center (AFWC), Maxwell AFB, AL 36112.

POINT OF CONTACT: Col. T. Yax, AUCADRE/WGO, Maxwell AFB, AL 36112, (205) 293-6618, AV 875-6618.

PURPOSE: The Soviet Troop Control Air Model exposes participants to Soviet front-level planning and decision processes required to develop and execute an air campaign in support of theater ground objectives. It allows the user to plan his campaign strategy in a time and space relationship based upon stated objectives from theater commanders.

DESCRIPTION:

Domain: Air operations in support of ground theater objectives.

Span: Any geographic area.

Environment: A time-phased operations plan from which the Deputy Commander for Air can compute attrition, employment, and support of commanded air assets.

Force Composition: Combined force campaign allows the Commander to control all assets at his disposal. Force structure is left up to the scenario developer.

Scope of Conflict: Conventional only.

Mission Area: Escort, air support, air strike, defense suppression, airfield attack, and cover.

Level of Detail of Processes and Entities: Air commander control extends down to assigning air regiments to specific mission areas.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Progress is determined by user inputs.

Treatment of Randomness: Deterministic.

Sidedness: One-sided. Air command staff normally consists of one to three participants.

LIMITATIONS: Ground forces commander computer model is not developed.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Creation and integration of ground force models (front and Army level).

INPUT: There are three phases. The first phase, mission receipt and clarification, requires the user to input theater goals and objectives. The second phase allows the user to allocate and rerole air assets to meet these

goals. The final phase determines expected attrition and allows the commander to plan for future operations.

OUTPUT: The model automatically generates reports on friendly and enemy order of battle, force allotment, allotment refinement, force attrition, future operations planning, and expected support available to the ground forces commander.

HARDWARE AND SOFTWARE:

Computer (OS):	IBM compatible MS-DOS machine with hard-disk storage, 640-KB RAM, printer, and color monitor.
Storage:	5 MB. Includes full complement of MS-DOS, SMART (integrated software package), and model files.
Peripherals:	Color monitor and printer.
Language:	SMART project files.
Documentation:	SMART and DOS manuals available. Model user and developer guide and scenario handbook also available.

SECURITY CLASSIFICATION: Standard unit of armament tables and figures are classified as Secret/NONFORN.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Scenarios created in approximately four hours.

CPU time per Cycle: N/A.

Data Output Analysis: Full range of reports includes user inputs and associated outputs.

Frequency of Use: At least once per year by each user.

Users: Air Command and Staff College and AFWC.

Comments: Managed through the review and configuration control board at the AFWC.

TITLE: Space CEM - Space Communications Effectiveness Model

MODEL TYPE: Simulation and analysis.

PROPONENT: AFEWC/SAX, Kelly AFB, TX 78243-5000.

POINT OF CONTACT: Franz Ley, (512) 925-2427, AV 945-2427.

PURPOSE: A family of integrated space system analysis modules specifically used to provide an analysis of space system communications as stressed by jamming, weather, and nuclear scintillation. The model visually depicts the system's operations dynamically through time with a 3-D graphics display.

DESCRIPTION:

Domain: Space, ground, air, and naval communications.

Span: All theaters, dependent on specific space system parameters.

Environment: Depicts system environment and operation on 3-D and flat displays as well as printed outputs.

Force Composition: Component.

Scope of Conflict: Electronic warfare.

Mission Area: All missions involved with space systems.

Level of Detail of Processes and Entities: Displays system configuration, ground stations, jammers, communications links, weather, system throughputs, nuclear scintillation grids, mobile and satellite paths through time, terrain and its effects on line-of-site, orbits, ground tracks, and other displays of dynamic space system interactions.

CONSTRUCTION:

Human Participation: Required for processes.

Time Processing: Model computing a time interval and displaying that time interval as an animated sequence of the system's operation for that time period.

Treatment of Randomness: Makes decisions based on parameters of the space system in question and on other measured inputs, not statistics. Makes decisions based on determined operation thresholds.

Sidedness: N/A.

LIMITATIONS: Current models only broadband noise jamming and single links.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Advanced jamming techniques, improved weather capabilities, network level message and throughput analysis, and system design level analysis.

INPUT: System orbital parameters, receiver, transmitter, and jammer parameters, and system operational guidelines.

OUTPUT: Graphic hard copy of displays, printed link environment summaries, videotape of dynamic scenarios, and printed output of nuclear effects on links.

HARDWARE AND SOFTWARE:

Computer:	MicroVAX II VMS operating system.
Storage:	5 MB of RAM.
Peripherals:	Evans & Sutherland PS 390 Graphics Processor, laser printer, and Tektronix 4692 color copier.
Language:	VAX FORTRAN, Evans & Sutherland Graphics language.
Documentation:	None.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: DMA DTED Level I digitized terrain, WDS II Geo Political Boundaries, and Space CEM data base.

CPU time per Cycle: Dependent on length of simulation and number of inputs. Varies from a few minutes to a week.

Data Output Analysis: None.

Frequency of Use: User dependent, used daily for system analysis.

Users: Used by AFEWC/SAX to perform analyses for AFOTEC, SAC, NASA, and other government agencies.

Comments: Model is currently a development model although several analyses have been done with it. Model is being added to on a regular bases as new features are requested and new requirements are identified by the users.

TITLE: SPAM - Self-Protection Analysis Model

MODEL TYPE: Analysis.

PROPONENT: Concepts Analysis Division, System Engineering Lab, Georgia Tech Research Institute, Georgia Institute of Technology, Atlanta, Georgia 30332.

POINT OF CONTACT: W. E. Sears III, (404) 894-3592.

PURPOSE: SPAM is a research and evaluation tool used to predict the effectiveness of a single threat weapon system against up to two target aircraft employing ECM.

DESCRIPTION:

Domain: Surface-to-air or air-to-air weapon system against target aircraft.

Span: One-on-one or one-on-two.

Environment: Flat earth.

Force Composition: One threat weapon system against one or two target aircraft.

Scope of Conflict: Conventional weapons.

Mission Area: Surface-to-air or air-to-air weapon system against one or two target aircraft.

Level of Detail of Processes and Entities: Engineering level of detail with particular emphasis on modeling of ECM and weapon system RF receiver and ECCM. ECM effectiveness is assessed using tracking errors and miss distance as measures of effectiveness.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic but some subprocesses, such as receiver noise or signal phase, may be modeled as random.

Sidedness: Two-sided, asymmetric, reactive.

LIMITATIONS: 3DOF flyout. Two targets. No clutter/multi-path for airborne radar. Assumes weapon system TTR already in track mode.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Integration with 6DOF flyout.

INPUT: Radar design and parameters, antenna pattern lookup table, aircraft RCS and jammer antenna pattern tables, missile aerodynamic data, and ECM waveforms.

OUTPUT: Printouts and plots.

HARDWARE AND SOFTWARE:

Computer: MicroVAX, VMS.
Storage: 20 MB.
Peripherals: Dot matrix printer, PC with GKS, and laser printer.
Language: FORTRAN.
Documentation: A nonintegrated collection of technical memoranda.

SECURITY CLASSIFICATION: Unclassified, but data bases may be classified.

GENERAL DATA:

Date Implemented: 1980.

Data Base: Several days to prepare.

CPU time per Cycle: 2-15 minutes.

Data Output Analysis: May be used as output.

Frequency of Use: Constant.

Users: Used by Georgia Tech Research Institute on government contracts for TAWC, ASD, WRALC.

TITLE: SPAN - Signal Parametric Analysis of Potential Critical Nodes

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Electronic Proving Ground [ATTN: STEEP-(T-E)], Ft. Huachuca, AZ 85613-7110.

POINT OF CONTACT: Steven Cooper, (602) 538-4953, AV 879-4953.

PURPOSE: SPAN is an operational support tool (decision aid) that contains electronic signature templates of both BLUE and RED command posts and other critical nodes in a tactical deployment. SPAN is primarily used to determine the practicality of using collectable and measurable electromagnetic parameters that are emitted by battlefield transmitters to identify potential, critical, battlefield targets.

DESCRIPTION:
Domain: Land.

Span: RED threat forces.

Environment: RF domain identifying signatures.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: Contains all collectable emitter RF characteristics of both BLUE and RED forces in full warfare in central Europe from 100 KHz to 16 GHz. Contains type of node, type of equipment, frequency, tuning range, type of modulation, pulse repetition rate, pulse duration, antenna scan data, and number of channels, as applicable, for each emitter at each critical node. In addition, information concerning the validity of the data is also provided for the RED emitters. The collectable RF data is grouped into parametric classes to provide the capability to determine which parametric class (i.e., template) can be emitted by particular types of critical nodes.

CONSTRUCTION:
Human Participation: None.

Time Processing: Static.

Treatment of Randomness: None.

Sidedness: N/A.

LIMITATIONS: RED data limited to central Europe.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None at present.

INPUT: Input data files consist of the data base files created by the SPAN data base software, the directions finder intercept report file, and collocated node information.

OUTPUT: Identification of unique nodes, partial nodes, the detected collocated nodes, and misidentified nodes.

HARDWARE AND SOFTWARE:

Computer:	CYBER 170 and 172.
Storage:	200,000 octal words of 60 bits.
Peripherals:	1 disk storage, 1 magnetic tape drive, and 1 printer.
Language:	FORTRAN 77.
Documentation:	Limited available.

SECURITY CLASSIFICATION: Unclassified, but full data base Top Secret/SI. Collateral Secret version available, but provides limited results.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Preparation of data base can take several man-years. Updates vary according to content.

CPU Time per Cycle: Varies with size.

Data Output Analysis: Produces hard copy results.

Frequency of Use: Limited. Last run 1985.

Users: USAICS.

Comments: This is essentially a data base used to support the SPAN Simulation Model. It has been used to support field applications for CEWI collections systems such as TCAC-D.

TITLE: SPEED84 - Simulation of Penetrators Encountering Extensive Defense

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. Bill McQuay, (513) 255-2164.

PURPOSE: SPEED84 is designed to provide a methodology by which the analyst can understand the interactions among the penetrating forces and the various facets of an integrated air defense system, and quanititatively assess the overall impact on bomber force effectiveness of penetration system variations including the number of air vehicles, ECM used, and decoy deployment.

DESCRIPTION:

Domain: Land and air.

Span: Regional.

Environment: A few impacts of weather, such as the effects of clouds, can be modeled. Ground sites are degraded in their tracking abilities as are threat kill capabilities.

Force Composition: Joint and combined forces.

Scope of Conflict: Conventional and nuclear.

Mission Area: Integrated air defense.

Level of Detail of Processes and Entities: Airspace is defended by an extensive network of early warning and GCI radars, command and control systems, airborne interceptors and surface-to-air weapon systems. The airborne forces may include manned bombers, cruise missiles, air-to-surface missiles, gravity bombs, decoys, and support aircraft such as remotely piloted vehicles.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric; only the defender reacts to events within the engagement.

LIMITATIONS: Many specific aspects of the battle modeled are subject to considerable aggregation.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Penetrator vehicle types, radar type, RF/EO detection tables, threat description, ground threat probability tables, interceptor description,

interceptor probability tables, long range missile fuel tables, weapon data, radar sites, ground threat sites, GCI sites, airbases, subcontrol centers, A/C characteristics, DGZs, manned vehicles, long range missiles, degradation tables, environmental effects, and ground-based jammers and sensors.

OUTPUT: Input echo, situation descriptions, listings, and plots.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	491,008 bytes.
Peripherals:	No special requirements.
Language:	FORTRAN IV.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: N/A.

CPU time per Cycle: 36.2 CPs.

Data Output Analysis: 4.2 CPs.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: SPIRITS - Spectral Infrared Imaging of Targets and Scenes

MODEL TYPE: Analysis.

PROPONENT: ECDES Program, ASD/RW, WPAFB.

POINT OF CONTACT: Lt. Col. Glenn Harris, ASD/RWAS, (513) 255-2108.

PURPOSE: SPIRITS is used for simulating infrared signatures of targets in air-to-air, ground-to-air, or ground-to-ground scenarios. The in-band spectral and spatial radiances are used in tactical and strategic sensor performance evaluation, target design and signature prediction, vulnerability analysis, and understanding measured data.

DESCRIPTION:

Domain: Land, sea, air, space, or a combination of land, sea, air, and space.

Span: Accomodates any theater depending on the target data base.

Environment: Atmospheric transmission is calculated by LOWTRAN6.

Force Composition: Combined or component radiation.

Scope of Conflict: Conventional and nuclear warfare.

Mission Area: Searching, tracking, identification, and lock-on.

Level of Detail of Processes and Entities: Any target or group of targets can be modeled (air, ground, sea, space). Phenomena include exhaust plume flowfield and radiation for both axisymmetric and nonaxisymmetric nozzles, target emission and hot parts, reflected sunshine, earthshine, and skyshine, target temperatures (nonuniform convection, radiative transfer, nonequilibrium conduction, internal heat sources), atmospheric transmission and radiance, and 3-D obscuration and display.

CONSTRUCTION:

Human Participation: Required for input descriptions and output analysis.

Time Processing: Static.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: Specific data base input format; no cluttered background.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Secondary reflections, expert system, structured background environment, LOWTRAN7, SIRRM2, general bidirectional reflectance distribution function, first principles heat transfer analysis, improved plume model, generalized object geometry, and polarized backgrounds.

INPUT: Plume flowfield and radiation descriptions, flight parameters (altitude mach number, ambient pressure and temperature, pitch and roll

angles, hot part temperatures and paint properties), sensor description (observer's aspect angle, range, aimpoint and field-of-view), and environment description (sun angle, type of earth below, earth altitude and temperature, sky or cloud description, and LOWTRAN6 atmospheric description).

OUTPUT: Spectral and spatial data of the target source (up to 10 bandpasses). Apparent and contrast radiant intensities, background and foreground irradiances, and source component radiant intensities. Raster image display of apparent in-band radiances for each pixel.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a VAX computer with a VMS operating system.
Storage:	8-9 megabytes of RAM.
Peripherals:	Raster display device, alphanumeric terminal, and printer.
Language:	ANSI standard FORTRAN 77.
Documentation:	User manual, technical manual, and installation manual.

SECURITY CLASSIFICATION: Critical Military Technology, Non-Exportable, Access prohibited to foreign nationals, inputs closely coupled with outputs can be considered classified.

GENERAL DATA:

Date Implemented: 15 September 1987.

Data Base: Many data bases exist from the commercial developer. A new data base requires one to three man-months to develop depending on the original format of the data.

CPU time per Cycle: Average run time (with a plume) is 25 minutes.

Data Output Analysis: Alphanumeric data may be sent to user-defined general purpose 2-D plotting routine.

Frequency of Use: Frequently used by those listed below.

Users: Aerodyne Research, AFEWC/ESA, AFGL/OPF, AFWAL/AAWA, ECAC, General Dynamics, General Electric, Georgia Tech, Grumman Aerospace, Lockhead, Loral E-O Systems, Martin Marietta, McDonnell Douglas, NADC, Northrop, PMTC, Rockwell International, Senders, Tricor Systems, MICOM, and Westinghouse Electric.

Comments: Managed through ECDES to ensure a standard version of the model. Industry coordinatior for distribition, training, and user support is Aerodyne Research, Inc.

TITLE: SRBS - Skeletal Reference Baseline System

MODEL TYPE: Analysis.

PROPONENT: National Test Bed, Falcon AFB, CO 80912-5000.

POINT OF CONTACT: Dudley L. Bromley, (719) 380-2337.

PURPOSE: SRBS is a low-to-medium fidelity model of the SDS that includes a flexible and sophisticated human-machine interface capability. SRBS is ideally suited to assist in the understanding and evaluation of human participation in a strategic defense environment. SRBS is currently being used by the U.S. Space Command to support strategic gaming.

DESCRIPTION:

Domain: Earth and space.

Span: Accommodates any theater depending on data base. Currently targeted areas include NATO, CONUS, and space-based SDS assets.

Environment: User-defined simulated GMT start time and ratio of simulation time to wall clock time. Two-dimensional Mercator projections and three-dimensional globe displays available.

Force Composition: Joint and SDS assets.

Scope of Conflict: Non-nuclear SDS assets including ERIS and SBICVs; RED arsenal components including ICBM, IRBM, SLBM, and ASAT.

Mission Area: All Phase I SDS missions.

Level of Detail of Processes and Entities: Model components include Battle Manager, Command and Control, Communications, Engagement, Environment (Earth, moon, sun, but no nuclear effects), Sensors, Threat, Weapons, and MMI. Battle Manager can be either regional or autonomous and includes both space- and ground-based elements. Weapons include ERIS, SBICV, HEDI, and SBL. Sensors include SSTS, BSTS, and GSTS. MMI includes RED, WHITE, and BLUE teams, with the BLUE team containing most C2 capabilities. Intelligence message-passing also available.

CONSTRUCTION:

Human Participation: Required for decisions and processes but can be locked down for repeatability.

Time Processing: Dynamic, either time- or event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided (RED offense, BLUE defense); WHITE umpire function is also provided.

LIMITATIONS: Approximately 1500 threat objects capable of being run in real time (per wave).

PLANNED IMPROVEMENTS AND MODIFICATIONS: Increase number of command element pe[illegible]nnel and command centers, integrate Rapid Screen Prototyping Tool, i[illegible]se threat scenario size, include Battle Manager Predictor, and integrate f[illegible]nalysis capability.

INPUT: Configuration file that defines SDS architecture and associated parameters, initialization file that defines scheduling and distribution of software module plus connectivity (i.e., messages) between modules, and scenario files that define threats

OUTPUT: MMI displays, log file of operator entries (for playback) and log file of recorded messages.

HARDWARE AND SOFTWARE:
Computer (OS): CRAY 2 Supercomputer, UNICOS Version 4 operating system; ELXSI 6400, EMBOS operating system.
Storage: 155 MB.
Peripherals: Silicon Graphics workstations (3000 series and 4D series).
Language: "C," FORTRAN, Pascal.
Documentation: CDRLs C001-005, IAG Design Criteria Document.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: January 1987.

Data Base: Time to prepare new threat data base varies from one to seven days depending on specifics of threat.

CPU time per Cycle: User can control ratio of real time to simulation time.

Data Output Analysis: Currently limited but will soon include full analysis capability.

Frequency of Use: Used daily.

Users: U.S. Space Command, National Test Bed Integration Contractor.

Comments: N/A.

TITLE: STAIR - Simulation of Tactical Airborne Interceptor Radar

MODEL TYPE: Analysis.

PROPONENT: Science Application International Corporation (SAIC).

POINT OF CONTACT: Mark D. Bond, SAIC, (404)-426-9359.

PURPOSE: The purpose of STAIR is to aid the radar systems analyst in the study of airborne radar detection phenomenology.

DESCRIPTION:
Domain: Air.

Span: One aircraft on one radar.

Environment: Round, smooth earth; atmospheric absorption.

Force Composition: Single element BLUE vs. RED or RED vs. BLUE.

Scope of Conflict: Accommodates airborne acquisition and fire control radar, although tracking radar is limited to detection only.

Mission Area: Single penetrator with jammer against a single radar.

Level of Detail of Processes and Entities: Lowest entity modeled is a radar subsystem: transmitter, pulse doppler or MTI circuit, noncoherent integrator, gain control. Pulse doppler and MTI processing implemented as actual system software.

CONSTRUCTION:
Human Participation: Not required or permitted.

Time Processing: Dynamic, real-time emulation.

Treatment of Randomness: Deterministic; random noise implemented in both phase and amplitude.

Sidedness: Symmetric.

LIMITATIONS: Does not model angle, range, or doppler tracking.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Moving target detector (MTD: MTI followed by pulse doppler), extended target and range tracking, and monopulse angle and doppler tracking will be added.

INPUT: N/A.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on VAX computer with VMS operating system.
Storage:	ALARMPP executable = 21,000 bytes. Input files = 75,000 bytes each (including antenna patterns).
Peripherals:	No peripheral support required for operation. A graphics display terminal to view templates is recommended.
Language:	FORTRAN.
Documentation:	A user's manual and input guide are available.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Data base construction time is minimal provided that preparation is performed by a qualified radar analyst.

CPU time per Cycle: Depends on purpose; may range from several CPU minutes to several CPU hours.

Data Output Analysis: Extensive knowledge of radar processing is required.

Frequency of Use: Extensive use by airframers in the analysis of low observables (LO) design.

Users: N/A.

Comments: Configuration is controlled by SAIC.

TITLE: STAM - SIOP Tanker Analysis Model

MODEL TYPE: Analysis.

PROPONENT: Boeing Military Airplanes, Operations Analysis, Box 7730, M/S k80-33, Wichita, KS 67277-7730.

POINT OF CONTACT: John A. December, Boeing Military Airplanes, Operations Analysis, (316) 526-2956.

PURPOSE: The purpose of the STAM is to determine the tanker requirements for the refueling support of a set of bomber sorties in a SIOP mission.

DESCRIPTION:

Domain: Land and air.

Span: Global.

Environment: Distances.

Force Composition: Strategic bombers.

Scope of Conflict: Nuclear.

Mission Area: SIOP.

Level of Detail of Processes and Entities: Entities: Individual aircraft. Processes: Single air refueling.

CONSTRUCTION:

Human Participation: Required to set up data files for execution.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Does not model aircraft loading, loading times, aborted air refuelings, and replacement aircraft.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Input files are required to provide the following information: SIOP force specification (bomber types, fuel burn data, aircraft parameters); and allocation option (type of tanker and costs).

OUTPUT: Output includes summary information on the number of aircraft and types used, fuel burn, and onload amounts; and detailed information on the times, distances, and amounts of each air refueling.

HARDWARE AND SOFTWARE:

Computer: Developed to run in a network of APOLLO DN3000 and DN660 terminals running on an AEGIS-DOMAIN/IX (Unix-based) operating system.

Storage: About 300K for the executable model. Data bases require additional space.

Peripherals: 1 printer and 1 terminal.

Language: APOLLO/DOMAIN Pascal and FORTRAN APOLLO DOMAIN/IX.

Documentation: Documentation for management, user/analysts, and programmers is available.

SECURITY CLASSIFICATION: Unclassifed, but data could be classified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Aircraft data base is established for many aircraft.

CPU time per Cycle: A typical run for finding the best tanker allocation based on user specification is 3 hours.

Data Output Analysis: Output reports include summary output and detailed output in chart form.

Frequency of Use: Used several times per year for tanker analyses.

Users: Boeing Military Airplanes, Operations Analysis, Tanker/Airlift Program Support.

Comments: N/A.

TITLE: STAT - Strategic Transportation Analysis Tool

MODEL TYPE: Analysis.

PROPONENT: Sandia National Labs (SNL), Albuquerque, NM 87185.

The BDM Corporation, 7915 Jones Branch Drive, McLean, VA 22102.

POINT OF CONTACT: Steven C. Haes, (703) 848-6804 or Edmund J. Bitinas, (703) 848-5246.

PURPOSE: STAT is a research and evaluation tool used to access transportation, logistics, and production network capabilities and limitations over a multi-model transportation network.

DESCRIPTION:

Domain: A transportation network representing sea, air, or ground transportation links and nodes.

Span: Data-driven, from global to local.

Environment: Data-driven; includes time of day and trafficability.

Force Composition: Individual vehicles in convoy packages. Airlift, sealift, heliborne can also be included.

Scope of Conflict: Rear-area. Weapons represented by the effect of using them, including persistent effects.

Mission Area: Sustainability, mobilization, and interdiction.

Level of Detail of Processes and Entities: Trains, items of productions and supply specific or by tonnage (up to 9999 types), specific production facilities, and specific targets. Attrition/damage is input by weapon type. Delay is input as time to repair/reconstitute once assets to perform the repair are made available.

CONSTRUCTION:

Human Participation: Not required. Model interruptable with scheduled changes.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Deterministic. Random values are generated from input distributions.

Sidedness: One-sided.

LIMITATIONS: Demands for materials, attacks, and loss of territory must be pre-scripted.

PLANNED IMPROVEMENTS AND MODIFICATIONS: To increase user friendliness of preprocessors and postprocessors.

INPUT: Transportation network (road and rail are available for all of Europe, Korea, and Iran, while only railroad data bases are available for the Soviet Union), scenario, asset stockpiles, asset consumption rates, production rates and inventory levels.

OUTPUT: Postprocessor provides statistically analyzed data overlaid on videodisk map backgrounds or screen and/or hard copy graphics plots available. Data includes resource and network utilization, supply availability, force arrival rates, and other dynamic measures.

HARDWARE AND SOFTWARE:

Computer:	IBM PS/2 model 80.
Storage:	10 MB.
Peripherals:	Fulcrum videodisk mapping display systems and printer.
Language:	FORTRAN.
Documentation:	User's manual and internal code documentation.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: July 1985.

Data Base: One to three man-months.

CPU time per Cycle: Scenario- and scale-dependent; typically one to eight hours for entire run.

Data Output Analysis: Postprocessor provides graphics and raw data output.

Frequency of Use: Undetermined.

Users: Sandia National Labs, Joint Strategic Target Planning Staff (JSTPS), and The BDM Corporation.

Comments: None.

TITLE: STEWS - Simulation of Total Electronic Warfare Systems

MODEL TYPE: Analysis.

PROPONENT: Naval Research Laboratory, Code 5707, Washington, DC 20375-5000.

POINT OF CONTACT: Mr. S. Leroy, (202) 767-2013, AV 297-2897.

PURPOSE: STEWS evaluates ESM systems effectiveness in medium-scale to large-scale electromagnetic environments. It is a research and evaluation tool that emulates EW receivers.

DESCRIPTION:

Domain: Land, sea, and air in any combination.

Span: Local and regional.

Environment: Land masses with no terrain; seas, but no sea states.

Force Composition: Platforms, missiles, and RED and BLUE emitters.

Scope of Conflict: Purely electromagnetic environments including surveillance radars, jammers, decoys, etc.; no EO/IR or hard kill weapons.

Mission Area: Outer air battle into inner defense zone.

Level of Detail of Processes and Entities: Platforms and missiles move about in 3-D space according to planned tracks. Antennas rotate or scan electronically. Emitters turn on and off and can be represented down to the pulse level. ESM simulations can perform as superheterodyne receivers, IFMs, crystal video, radars, etc. Level of detail is either signal level or pulse-by-pulse. Library functions perform threat ID. Associated EW system displays and dynamic scenario displays run simultaneously on RAMTEKs to allow for man-in-the-loop interaction.

CONSTRUCTION:

Human Participation: Not required, but can be introduced via the EW system operator interfaces if desired without model interruption.

Time Processing: Dynamic; some ESM systems may use fixed time steps, others are variable time steps caused by behavioral response of EW system to the current events. Other systems, such as radars, can be ratio-adjusted to maintain a fixed wall clock time to game time ratio.

Treatment of Randomness: Environment building process is either deterministic or stochastic in determining initial platform positioning, antenna pointing, emitter parameter values, etc. Emitter parameter measurements of ESM system models may be stochastic. All stochastic processes are performed via draws from pseudorandom number sequences. All runs are repeatable given the same seeds.

Sidedness: Two-sided, asymmetric, one side (the environment) nonreactive. ESM system to ESM system can be two-sided, symmetric.

LIMITATIONS: No terrain features currently in scenarios, no atmospheric effects, and no flat earth approximation for range calculations.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Introduction of DTED and sea state for multi-path and line-of-sight calculations; ellipsoid and spherical earth models for long-range calculations; atmospheric effects on propagation; speedup of ESM models to run the STEWS Operational Situations Simulations (SOS) in real time; redirection of platforms and missiles in SOS runs to have two-sided, symmetric sidedness; and hard kill models to allow for attrition contribution of such weapons.

INPUT: STEWS scenarios; detailed ESM system characteristics of the processing and intercepting logic of the receivers; and inputs of the frequency coverage, sensitivity, timing characteristics of various functions, etc.

OUTPUT: All printed output, including histories, emitter summary reports, reports broken down by frequency coverage bands, and random files containing all required emitter events for postprocessing by Model Analysis Programs (MAPS), is optional. Scenario analyses provide hard copy and plots of pulse densities and scenario dynamics.

HARDWARE AND SOFTWARE:

Computer:	VAX computer with VMS; may run on a VMS clone.
Storage:	STEWS software approximately 35,000 blocks. Individual ESM system models typically 10,000 - 15,000 blocks.
Peripherals:	Minimum 1 high-speed printer (1200 LPM); 2 VT100, VT200, or VT300 series terminals; 1 Tektronix 4014, 4016, or 4125 series terminal; 2 RAMTEKs for ESM system displays.
Language:	VAX FORTRAN.
Documentation:	17 documents plus any new issues as available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Several man-months to several man-years to collect scenario intelligence. ESM information depends on availability of specs or vendor.

CPU time per Cycle: Depends on scenario size and level of detail of each ESM simulation; can vary from wall clock time to scenario time ratio of 1:1 to 300:1 (300:1 in the case of very fine level of detail simulations with heavy message passing across a DECNet network) on VAX 8650s.

Data Output Analysis: MAPS analyses, scenario analyses, and scenario utilities produce a wide variety of hard copy and graphics output.

Frequency of Use: Approximately 700 times per year.

Users: Only users of current software are NRL and MITRE Corp. DREO Canada; DRCS Australia; AFAL WPAFB; and EWL, Ft. Monmouth, use earlier versions.

Comments: STEWS Version 2.2 is continually upgraded, debugged, etc.

TITLE: STOCHADE

MODEL TYPE: Analysis.

PROPONENT: MA Department, RARDE (Fort Halstead,) Sevenoaks, Kent, U.K.

POINT OF CONTACT: System Assessment Group, Royal Military College of Science (0793) 785285.

PURPOSE: STOCHADE is a fast, highly aggregated model of heterogeneous direct-fire battle used as a research tool or as support for a higher-level game.

DESCRIPTION:

Domain: Abstract; generally taken to be land.

Span: Local or regional.

Environment: N/A.

Force Composition: Mixed force of direct-fire weapons.

Scope of Conflict: Conventional.

Mission Area: N/A.

Level of Detail of Processes and Entities: Individual weapons aggregated into groups of weapons of different types.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Two versions exist. The deterministic version is time-step, and the stochastic version is event-step.

Treatment of Randomness: Deterministic model uses solution of a system of Lanchester-type differential equations. Stochastic version is a simulation solution of the stochastic equivalent of the deterministic equation.

Sidedness: Two-sided, symmetric.

LIMITATIONS: STOCHADE is a highly aggregated model in which ranges of engagement are modeled according to the "centers of gravity" of the force.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Numbers of each weapon type, kill rates, speed of advance, target selection rules, intervisibility and detection probabilities, fractional kill rate capabilities for moving weapons and targets, and proportion of fire on dead or false targets.

OUTPUT: In the deterministic version it is the number of survivors of each weapon type as a function of time and range. In the stochastic version (optional), for each run, the output consists of casualties, target weapon, firing weapon, and battle time order of fill.

Program routine: A summary of a number of replications gives the following: number of RED and BLUE wins with 95% confidence intervals; average time of battle, average time for RED win, average time for BLUE win (all with standard deviations); mean and standard deviation of number of RED and BLUE survivors for each weapon type; and frequencies and histograms of numbers of survivors for each weapon type.

HARDWARE AND SOFTWARE:

Computer: A Hewlett Packard 9835A desktop computer and VDU, with optional disk-drive, printer, and graph plotter; VAX 11/750 at RARDE.

Storage: N/A.

Peripherals: N/A

Language: Hewlett Packard Extended BASIC and VAX FORTRAN at RARDE.

Documentation: User guide, program listing, and model descriptions.

SECURITY CLASSIFICATION: N/A.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Minutes to input data.

CPU time per Cycle: Depending on data, 3-15 seconds per replication.

Data Output Analysis: N/A.

Frequency of Use: Continuous at RARDE.

Users: RARDE and RMCS.

Comments: N/A.

TITLE: STRATC2AM - Strategic Command Control Architecture Model (formally SIMSTAR)

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SASS), The Pentagon, Rm 1D431, Washington DC 20330-5420.

POINT OF CONTACT: Lt Col Graney, AFCSA/SASS, Av 227-9408.

PURPOSE: STRATC2AM analyzes communications systems effectiveness in both ambient and wartime conditions.

DESCRIPTION:
STRATC2AM is a data base-driven, event-scheduled, Monte Carlo computer simulation of C3 network performance in both nuclear disturbed and ECM environments. The model has three sections: the preprocessor to develop the scenario data bases; the simulator to calculate the availability of C3 assets and signal propagation and the probability of message receipt; and the postprocessor to report the Monte Carlo results.

Domain: ELF through MM wave.

Span: Global (terrestrial, airborne, space based, fixed, or moving).

Environment: Data base driven.

Force Composition: N/A.

Scope of Conflict: Only limited by array sizing--see Limitations below.

Mission Area: Primarily strategic, systems level analysis.

Level of Detail of Processes and Entities: Individual transmitters and receivers residing on individual nodes. Each node and transmitter/receiver may have reliabilities and probabilities of kill associated with it. Each transmitter and receiver have one or more processes associated with it to describe C2 procedures or delays.

CONSTRUCTION:
Human Participation: Extensive to build data base(s). Not required during simulation run.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Deterministic propagation calculations and stochastic scenario and systems operation.

Sidedness: N/A.

LIMITATIONS: The current version is sized for: 400 nodes with 15 transmitters and receivers, 99 transmitter classes, 99 receiver classes, 50 resource pools, 50 jammers, 5000 bursts, and 10 individual messages (up to 100 in the network at one time).

PLANNED IMPROVEMENTS AND MODIFICATIONS: Report Generator System, Data Base Manager, DNA V&V of propagation code, and GATE integration.

INPUT: Equipment specifications (frequency, power, bandwidth, modulation, antenna, etc.), message routing processing delays, and scenario (time, bursts, jammers, and ERTs).

OUTPUT: Thirteen separate statistical reports.

HARDWARE AND SOFTWARE:

Computer: IBM 3084 MVS/XA, VAX 11-780, MicroVAX, etc. with VMS. Future improvements may require a PC and a SUN.

Storage: N/A.

Peripherals: N/A.

Language: FORTRAN 77.

Documentation: User's and programmer's manuals for each section.

SECURITY CLASSIFICATION: Simulator code: SECRET/RD.
Data Bases: Unclassified to top secret.
Output: Unclassified to top secret (normally top secret).

GENERAL DATA:

Date Implemented: N/A.

Data Base: Preprocessor data collection and input dependent on complexity of scenario (days to months for first data base development).

CPU time per Cycle: Simulator: minutes to hours.

Data Output Analysis: Postprocessor: minutes.

Frequency of Use: N/A.

Users: AF, Army, JS, JSTPS, and OSD.

Comments: N/A.

TITLE: STRAT DEFENDER Model

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SASS), The Pentagon, Room 1D431, Washington, DC 20330-5420.

POINT OF CONTACT: Capt Dave Goss, AFCSA/SASS, (202) 697-6086, AV 227-6086.

PURPOSE: STRAT DEFENDER is an event-oriented, Monte Carlo simulation of a strategic defense system interacting with a deterministic attacking force of bombers, and air-to-surface and cruise missiles. The model was originally developed at HQ NORAD and has been modified for AFCSA/SASS use.

DESCRIPTION:
Domain: Land, air, and space.

Span: Global.

Environment: Radar: Largely smooth earth, except in detailed AWACS modeling where limited background types are used. Infrared: Three types of earth background: land, water, and snow. Each type has an associated emissivity. Clouds are modeled by giving cloud heights at one-degree latitude and longitude increments around the globe.

Force Composition: RED strategic air-breathing forces vs. BLUE defensive forces, including ground radars, AWACS, space-based sensors, fighter interceptors, and SAMs.

Scope of Conflict: Nuclear.

Mission Area: Strategic nuclear bombardment.

Level of Detail of Processes and Entities: STRAT DEFENDER simulates the movement of bombers, air-to-surface missiles, and cruise missiles over a spherical earth as well as their interaction with a defense network. Interceptors are committed from bases or orbit points on a variety of intercept profiles including aircraft fuel monitoring and reattack logic of the profiles selected. End-game actions of detection, conversion, and missile kill are modeled stochastically.

CONSTRUCTION:
Human Participation: Required for building attack plan and locating defensive forces. However, humans do not intervene in the simulation once it has begun.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Uses both deterministic and stochastic techniques. Events such as entering into and exiting out of radar and SAM coverage and fighter commitment result from geographic and spatial relationships. However, kills by fighters and SAMs, fighter maintenance requirements, and certain time delays are stochastically represented.

Sidedness: Two-sided, asymmetric. Defensive forces can react to the emerging battle, but penetrators must follow preplanned routes.

LIMITATIONS: Terrain is not modeled, and command and control connectivity is considered complete with some delays.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: RED attacking force data, including flight routes and their characteristics (speed and altitude); penetrator signatures, both radar and infrared; and target locations. BLUE defensive force data, including fighter and SAM orders-of-battle, fighter and SAM performance data, radar performance data, and rules of engagement.

OUTPUT: Printed listing of events as they occurred in time. Further, each type of event can be saved in its own history file as it occurs. Summary data includes the number of penetrators killed by type, fighter maintenance statistics, and radar detection statistics.

HARDWARE AND SOFTWARE:

Computer:	IBM 3081 with MVS/XA.
Storage:	At least 700 KB, with more required as the amount of input data increases.
Peripherals:	Standard input and output devices.
Language:	SIMSCRIPT II.5.
Documentation:	User's manual, analyst's manual, and programmer's manual.

SECURITY CLASSIFICATION: Source code is unclassified.

GENERAL DATA:

Date Implemented: 1980.

Data Base: Depends upon scenario.

CPU time per Cycle: From 20 seconds to 1 hour, depending upon the scenario.

Data Output Analysis: Depends upon scenario.

Frequency of Use: Daily.

Users: SASS, JDSSC/C312, ANSER Corporation, and others.

Comments: None.

TITLE: STRAT PATROLLER Model

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SASS), The Pentagon, Room 1D431, Washington, DC 20330-5420.

POINT OF CONTACT: Capt Dave Goss, AFCSA/SASS, (202) 697-6086, AV 227-6086.

PURPOSE: STRAT PATROLLER analyzes interceptor detection capability.

DESCRIPTION:
Domain: Air.

Span: Global.

Environment: Radar: Largely smooth earth with some ground clutter. Infrared: Temperature, humidity, visibility, and percent cloud cover used to represent the atmosphere.

Force Composition: RED strategic air-breathing forces vs. BLUE defensive fighter forces.

Scope of Conflict: Conventional.

Mission Area: Strategic nuclear bombardment.

Level of Detail of Processes and Entities: STRAT PATROLLER models the scanning process of fighter radar antennas and infrared search sets; the detection capability of those radars, infrared search sets, and the aircrew; and the radar, infrared, and visual observable characteristics of penetrator aircraft and cruise missiles. Noise jamming and chaff are also modeled. STRAT PATROLLER allows fighter orbit shapes and sensor search patterns to be varied on each leg of the orbit to analyze the detection capability of a given interceptor aircraft against a given threat.

CONSTRUCTION:
Human Participation: Required for building attack plan and locating defensive forces. However, humans don't intervene in the simulation once it has begun.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Uses both deterministic and stochastic techniques. Events such as entering into and exiting out of radar and SAM coverage and fighter commitment result from geographic and spatial relationships. However, detecting penetrators is a random process driven by the detection probability they accumulate as they transit their flight paths.

Sidedness: Two-sided, symmetric. Defensive forces can react to the emerging battle, but penetrators must follow preplanned routes.

LIMITATIONS: Terrain is not modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: RED attacking force data, jamming and chaff conditions, interceptor orbit parameters, and detailed radar and infrared performance data.

OUTPUT: Selective levels of output detail are possible through a series of key words. Probability of detection for specific scenarios is the primary output of this simulation.

HARDWARE AND SOFTWARE:

Computer:	IBM 3081 with MVS/XA.
Storage:	At least 100 KB, with more required as the amount of input data increases.
Peripherals:	Standard input and output devices.
Language:	SIMSCRIPT II.5.
Documentation:	User's manual, analyst's manual, and programmer's manual.

SECURITY CLASSIFICATION: Source code is unclassified.

GENERAL DATA:

Date Implemented: 1980.

Data Base: Depends upon scenario.

CPU time per Cycle: Depends upon scenario.

Data Output Analysis: Depends upon scenario.

Frequency of Use: Twice per year.

Users: SASS.

Comments: None.

TITLE: STRAT RANGE

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SASB).

POINT OF CONTACT: Lt Col Remington, AFCSA/SASB, ext. 79748.

PURPOSE: STRAT RANGE calculates single sortie strategic bomber aerial refueling support requirements.

DESCRIPTION:

Domain: Air.

Span: Global.

Environment: All weather.

Force Composition: BLUE.

Scope of Conflict: Strategic nuclear.

Mission Area: Strategic nuclear (air-breathing).

Level of Detail of Processes and Entities: The entity is a single aircraft. The processes are bomber missions supported defined in terms of mission segment distances and payload.

CONSTRUCTION:

Human Participation: Required for decisions; model waits for decisions.

Time Processing: Static.

Treatment of Randomness: N/A.

Sidedness: One-sided.

LIMITATIONS: Time consuming.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Modify to read batch files and output to printer or disk.

INPUT: Bomber type, payload configuration, fuel load, and flight profile are input along with the type of tanker.

OUTPUT: Using MS-DOS print screen command, full or abbreviated printouts are available giving bomber flight distance, fuel remaining, and gross weight for each leg of the flight profile. Aerial refueling demand is noted in fractions of tankers.

HARDWARE AND SOFTWARE:

Computer: IBM compatible/DOS.
Storage: Floppy disk.

Peripherals: Screen output.
Language: FORTRAN.
Documentation: Limited.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1976.

Data Base: From one week to two months.

CPU time per Cycle: On the order of a few seconds per sortie run.

Data Output Analysis: Minimal.

Frequency of Use: As needed.

Users: AFCSA/SASB, Rand, and Northrop.

Comments: None.

TITLE: STRAT SURVIVOR

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SASB), The Pentagon, Room 1D431, Washington, DC 20330-5420.

POINT OF CONTACT: Maj Rolando, AFCSA/SASB, (202) 697-9804, AV 227-9804.

PURPOSE: STRAT SURVIVOR is used to analyze the strategic base escape problem.

DESCRIPTION:

Domain: Land and air.

Span: Regional.

Environment: Gust effects have been added to the model, but the changes to the model have not been validated.

Force Composition: BLUE ground alert aircraft escaping from a pattern attack by RED submarine-launched ballistic missiles.

Scope of Conflict: Strategic nuclear.

Mission Area: Strategic nuclear (air-breathing).

Level of Detail of Processes and Entities: The model uses simplified descriptions of aircraft performance and vulnerability and relatively comprehensive damage algorithms based on the "DIA Physical Vulnerability Handbook" equations, the cumulative log-normal distribution, and algorithms developed by the Air Force Weapons Laboratory. The potential kills are summed and weighted to form an aggregation value matrix. The optimum weapon allocation is then selected using a standard transportation problem solution technique in a combination of base-by-base and missile round-by-round optimization. The model will allocate multiple missiles on a target when it is feasible and profitable.

CONSTRUCTION:

Human Participation: Not known--individual who maintained the model is no longer in SA, and the model has not been used for several years.

Time Processing: Static.

Treatment of Randomness: N/A.

Sidedness: One-sided.

LIMITATIONS: Much of the optional output is inaccessible and much of the existing output is inexplicable. The model has not been validated since the last changes.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Aircraft characteristics, threat data (types and locations of submarines), and offensive and defensive tactics data. The beddown can be scenario-optimized if desired.

OUTPUT: Surviving aircraft are summarized by individual aircraft, aircraft type, base, and submarine. Optional outputs include peak overpressure and thermal levels experienced by individual aircraft and plots of aircraft paths and weapons DGZs.

HARDWARE AND SOFTWARE:

Computer: IBM 3081 with MVS.
Storage: N/A.
Peripherals: N/A.
Language: FORTRAN.
Documentation: Analysts' manual, users' manual, and programmers' manual.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: 1977.

Data Base: Two weeks.

CPU time per Cycle: Thirty minutes.

Data Output Analysis: One hour (per set of replications).

Frequency of Use: Not currently used.

Users: Last known users: AFCSA/SASB.

Comments: None.

TITLE: Strike

MODEL TYPE: Training and education (support of seminar war games).

PROPONENT: Wargaming Department, Naval War College.

POINT OF CONTACT: Micromodels Manager, (401) 841-3276, AV 948-3276.

PURPOSE: Strike models multi-aircraft strikes against defended land targets. It is designed to support battle damage assessment in conjunction with larger war games.

DESCRIPTION:

Domain: Land.

Span: Local.

Environment: N/A.

Force Composition: Strike aircraft, air- and ground-based defenses.

Scope of Conflict: Conventional strike and AAW.

Mission Area: Strike warfare, AAW.

Level of Detail of Processes and Entities: User defines geographic area, strike composition, armament and flight profiles, defender air- and ground-based AAW defense locations and composition.

CONSTRUCTION:

Human Participation: Required for initial inputs only.

Time Processing: Closed form.

Treatment of Randomness: Outcomes stochastically based on direct computation of probabilities, with Monte Carlo determination of result.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Only useful for specific engagement vice aggregated results. User input-intensive.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None anticipated.

INPUT: Map and target locations, strike composition and armament, location, composition and armament of air- and ground-based defenses.

OUTPUT: Cumulative detections, aircraft losses by aircraft type, weapons expenditures, percentage target damaged/destroyed report.

HARDWARE AND SOFTWARE:

Computer: IBM-compatible PC with 512K RAM.

Storage: N/A.

Peripherals: Printer.
Language: "C."
Documentation: User's manual, design description, source code.

SECURITY CLASSIFICATION: Unclassified, but data base is classified.

GENERAL DATA:
Date Implemented: 1988.

Data Base: One hour.

CPU time per Cycle: N/A.

Data Output Analysis: None.

Frequency of Use: Several times per year anticipated.

Users: Wargaming Department, Naval War College.

Comments: Strike is designed to be used in conjunction with the Kinematics and Surface-Air Battle models. Data bases are compatible. Users should be able to move freely among all three models. Strike may be used independently to provide battle damage assessment information in support of larger war games.

TITLE: STRIKER - Tomahawk Land Attack Effectiveness Simulation

MODEL TYPE: Analysis.

PROPONENT: McDonnell Douglas Missile Systems Company, P.O. Box 516, St. Louis, MO 63166.

POINT OF CONTACT: John Fox, (314) 233-0663.

PURPOSE: STRIKER models a BLUE force of cruise missiles and tactical aircraft that attack land targets and land-based RED force defensive systems. It analyzes the survivability and effectiveness of the BLUE force in support of engineering analyses for weapon system development, and the development of tactical doctrine, such as the effectiveness of a mix of weapon systems against targets.

DESCRIPTION:

Domain: Air, land, and sea.

Span: Theater or regional.

Environment: Any land area for which digital terrain elevation data is available.

Force Composition: BLUE force cruise missiles and tactical aircraft. RED force ground targets, SAM sites, and AAA sites.

Scope of Conflict: Conventional weapons.

Mission Area: Defense suppression and target damage.

Level of Detail of Processes and Entities: Missiles (BLUE and RED), aircraft, and air-to-ground weapons (HARM, bombs, Walleye, Tacit Rainbow) are represented individually and are modeled with three or more degrees of motion. Radar performance models include radar range equation, multipath, ground clutter, and terrain masking. The Tomahawk cruise missile model uses real Tomahawk elevation guidance logic. HARM and Tacit Rainbow models include all guidance and attack logic modes. Attrition stops motion. Damage to a necessary component suppresses a system. For example, the loss of a SAM site radar suppresses the site.

CONSTRUCTION:

Human Participation: User plans scenario and creates input files. Scenario parameters are not modified during a simulation run (runs with or without graphics). During a graphics run, user can stop and restart simulation, adjust running speed, and zoom and pan display.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric. RED force is reactive, BLUE force is partly preplanned and partly reactive.

LIMITATIONS: Maximum of 100 cruise missiles, 50 BLUE aircraft, 200 ground targets, 100 SAM sites, and 200 AAA guns at 20 sites. These are compile-time parameters, which can be easily adjusted.

PLANNED IMPROVEMENTS AND MODIFICATIONS: RED force additions: early warning radars, filter centers, command and control, AWACS, GCI radars, interceptor aircraft. BLUE force additions: SLAM, laser-guided bombs, decoys.

INPUT: Digital terrain elevation data, BLUE and RED force weapon characteristics, cruise missile mission plans, BLUE aircraft flight plans, Tacit Rainbow mission plans, RED defense site locations, SAM site firing doctrine and sector options, and weaponeering inputs for target damage simulation.

OUTPUT: Dynamic color graphics display of strike area showing moving vehicles, targets, and flight plans; dynamic text display showing summary of RED and BLUE kills; dynamic text display of information about one user-selected vehicle; and computer file outputs with target damage assessment, BLUE force attrition, RED force attrition, and detailed time history of events.

HARDWARE AND SOFTWARE:

Computer:	VAX/VMS.
Storage:	Approximately 5 MB of main (virtual) memory, 100,000 blocks of disk storage, plus DTED data (5700 blocks per area of 1 degree latitude by 1 degree longitude).
Peripherals:	Tektronix 4115 or 4125 graphics terminal.
Language:	FORTRAN 77 with DEC extensions.
Documentation:	Simulation catalog entry (21 pages), model description (89 pages), user manual (60 pages).

SECURITY CLASSIFICATION: Secret. (Nearly all code is unclassified, but a small number of subprograms are secret or confidential.)

GENERAL DATA:

Date Implemented: 1984.

Data Base: Two to four weeks for a new scenario; less if working from an existing scenario.

CPU time per Cycle: Depends on scenario size. One case of 25 cruise missiles, 29 SAM sites, and 17 AAA sites took 62.5 CPU minutes for 25 Monte Carlo iterations.

Data Output Analysis: Depends on the intent of the analysis. A data reduction program is available to select, sort, and summarize event file data.

Frequency of Use: Used monthly.

Users: Used internally by McDonnell Douglas. Programs include Tomahawk, Cruise Missile Mission Planning, Advanced F/A-18, Tacit Rainbow, SLAM, AIWS.

Comments: Utilizes radar performance data generated by SALRAM, another McDonnell Douglas simulation. Enhancements are ongoing.

TITLE: Sub-on-Sub

MODEL TYPE: Training and education.

PROPONENT: Wargaming Department, Naval War College.

POINT OF CONTACT: Micromodels Manager, (401) 841-3276, AV 948-3276.

PURPOSE: Sub-on-Sub models submarine versus submarine detections and engagements. It is designed to support battle damage assessment in conjunction with larger-scale war games.

DESCRIPTION:

Domain: Sea.

Span: Individual.

Environment: Season/month, location, ocean area, sea state, shipping density.

Force Composition: Individual BLUE and RED submarines.

Scope of Conflict: Conventional sub-ASW weapons.

Mission Area: ASW.

Level of Detail of Processes and Entities: User specifies BLUE and RED submarine mission type and disposition (aggressive or evasive), platform class, and sensor and weapon types. Highly detailed dctection and engagement models.

CONSTRUCTION:

Human Participation: Required for initial inputs only.

Time Processing: Static.

Treatment of Randomness: Outcomes stochastically based on direct computation of probabilities, with Monte Carlo determination of result.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Only useful for very small engagement (i.e., one sub versus one sub). Output insufficiently detailed for analysis.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Update platform, sensor, and weapon parameters.

INPUT: Environment, BLUE/RED missions, platforms, sensors, weapons, countermeasure effectiveness.

OUTPUT: BLUE/RED detection MDRs, probabilities of detection, attack/closure, kill and reattack, and mean and random probability values.

HARDWARE AND SOFTWARE:

Computer: IBM-compatible PC with 512K RAM.
Storage: N/A.
Peripherals: N/A.
Language: BASIC.
Documentation: User's manual, design description, program code.

SECURITY CLASSIFICATION: Unclassified but data base is classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Done by contractor.

CPU time per Cycle: About 45 seconds.

Data Output Analysis: None.

Frequency of Use: 15-20 times per year.

Users: Wargaming Department, Naval War College.

Comments: None.

TITLE: SUPPRESSOR

MODEL TYPE: Analysis.

PROPONENT: Air Force Electronic Combat Office (AFECO), Wright Patterson AFB, Ohio 45433.

POINT OF CONTACT: Capt William Wheeler, (513) 255-2665/4270, AV 785-2665; Fred Steenrod (513) 254-3579; Pete Lattimore (505) 848-5185.

PURPOSE: SUPPRESSOR is a general-purpose, mission-level simulation model. It is used to evaluate different weapons systems, sensor systems, tactics, or command procedures in composite missions against an integrated air defense.

DESCRIPTION:

Domain: A combination of land, air, and sometimes limited naval operations.

Span: The center and region of the scenario are user defined; locations are referenced in an orthogonal coordinates system in meters. Some scenarios have exceeded a million meters in one dimension.

Environment: Can use an optional triangular terrain model built by processing DMA data using the SUPPRESSOR terrain processing steps.

Force Composition: Any mix of forces defined by the user's player type definitions and scenario descriptions; elaborate scenarios include nearly all known RED SAM and AAA systems, unmanned vehicles, and most types of military aircraft.

Scope of Conflict: Any weapon system whose effects can be represented with user-defined pK tables of various dimensions. Choices are between discrete weapon effects in which targets can be destroyed or continuous weapon effects in which targets accumulate a probability of survival from all engagements.

Mission Area: Any missions that can be represented using a set of user-defined weapon systems and tactics.

Level of Detail of Processes and Entities: User-built player definitions define level of detail; players most commonly represent one aircraft or ground vehicle. Communication and coordination between players are explicitly represented by events. Player capabilities depend on values that define the systems in a player definition. Systems are limited to eight categories: sensor receivers, sensor transmitters, receivers, communications transmitters, jammers, movers, weapons, and thinkers.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Event-step model.

Treatment of Randomness: Nearly all actions are deterministic; weapon effects may include randomness represented by comparing a random draw with an input probability.

Sidedness: Arranging players into sides is completely at the user's discretion; no limit on number of sides or their composition. All sides can be reactive and are rarely symmetric.

LIMITATIONS: Mission planning largely depends on user. Clutter effects on radar sensing not modeled. Weather effects remain constant during scenario.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Near-term improvements include a more readable input syntax, more flexible reactive movement tactics, and more flexible engagement and disengagement tactics.

INPUT: Input is divided into Type Data Base (TDB), Scenario Data Base (SDB), and Environment Data Base (EDB). TDB includes detailed characteristics of every player type that may be included in a scenario. SDB defines occurrences of player types with location data, planned paths, and zones of responsibility. Players are also grouped into chains of command and sides in SDB. EDB input is optional; includes DMA terrain data used to build a triangular terrain model for a scenario.

OUTPUT: Can include text description of more than 100 types of output incidents with information defining the acting player, the object of the action, and several associated items. The output can be sorted or reduced by windows, incident types, or player types. Graphics display tools available for depicting geographic data from scenarios.

HARDWARE AND SOFTWARE:

Computer:	Most commonly used on VAX systems, but also runs on almost any system with a good FORTRAN compiler.
Storage:	Small scenarios can be executed with 2 MB. Scenarios with terrain and more than 100 players need at least 25 MB.
Peripherals:	Terminals, printers, and disk drives.
Language:	FORTRAN 77 and VAX/VMS command procedures (not required).
Documentation:	Well documented by 3-volume user's guide, among others.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1983.

Data Base: Depends on number and complexity of players; example data bases with the most commonly used players are available.

CPU time per Cycle: Depends on the size of the scenario. Run time is nearly equal to simulation time on a VAX 11/780 for 30-40 player scenarios.

Data Output Analysis: Includes a postprocessor to sort output incidents.

Frequency of Use: Used at more than 80 sites in the U.S.

Users: More than 80 sites have been approved by AFECO.

Comments: Configuration control accomplished for AFECO by Electronic Combat Digital Evaluation System (ECDES) support contractor. All users must agree in writing to the terms and conditions in the ECDES Models Beta Site Access Agreement and must be approved by AFECO.

TITLE: SUWAM - Strategic Unconventional Warfare Assessment Model

MODEL TYPE: Training and education (support of seminar war games and exercises).

PROPONENT: Wargaming Department, Naval War College.

POINT OF CONTACT: Micromodels Manager, (401) 841-3276, AV 948-3276.

PURPOSE: SUWAM is designed to provide a special operations element into larger-scale war games.

DESCRIPTION:

Domain: Land.

Span: Individual.

Environment: Weather and terrain.

Force Composition: Individual special operations teams, indigenous personnel.

Scope of Conflict: Special operations team against unalerted target defenses.

Mission Area: Unconventional warfare.

Level of Detail of Processes and Entities: Four highly detailed major groups of interaction: infiltration, link-up, raid, and escape and evasion.

CONSTRUCTION:

Human Participation: Required for initial inputs only.

Time Processing: Closed form.

Treatment of Randomness: Outcomes stochastically based on direct computation of probabilities, with Monte Carlo determination of result.

Sidedness: Two-sided, asymmetric, one side reactive (defense).

LIMITATIONS: Only useful for very small-scale interaction.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None anticipated.

INPUT: Weather, terrain, mission type, infiltration and link-up plan, mission duration, and mission criticality.

OUTPUT: Highly detailed report of mission events. Each major interaction must be successful in order to proceed further in the mission.

HARDWARE AND SOFTWARE:

Computer:	IBM-compatible PC.
Storage:	N/A.

Peripherals: N/A.
Language: BASIC.
Documentation: User's manual, source code.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1984.

Data Base: Five minutes.

CPU time per Cycle: Five seconds.

Data Output Analysis: Descriptive narration of mission events.

Frequency of Use: Several times per year.

Users: N/A.

Comments: SUWAM was originally designed by the National Defense University Wargaming Center and modified by CINCPAC staff Operations Analysts.

TITLE: SUWAM 3.1 - Strategic Unconventional Warfare Assessment Model

MODEL TYPE: Training and education.

PROPONENT: Joint Warfare Center, Hurlburt Field, FL 32544-5000.

POINT OF CONTACT: LTC Eric J. Nelson, (904) 884-6928, AV 579-6928.

PURPOSE: SUWAM 3.1 is an updated, MS-DOS version of the National Defense University SUWAM III. It is an unclassified model, which can be used to produce mission results. As an exercise driver, SUWAM 3.1 has also been used to support larger, interactive Joint Training (Command Post) Exercises.

DESCRIPTION:

Domain: Land, sea, and air.

Span: Accommodates any theater.

Environment: Evaluates mission planning inputs and provides the probability of possible results or a set of possible results.

Force Composition: Joint and combined SOF.

Scope of Conflict: Model will assess direct action (raids), hostage rescue, strategic reconnaissance, infiltration (air, sea, and land), resupply, and indigenous force training.

Mission Area: SOF.

Level of Detail of Processes and Entities: Single- and multi-force missions are divided into a series of events. Each event is sequentially simulated to determine the outcome. Results of each event are randomly evaluated in light of opposition threat, target type, team and force size, mission criticality, terrain and environment, weather, and time allocated. Produces generic damage assessments and assessment translations for the mission.

CONSTRUCTION:

Human Participation: Required for decisions and processes. Knowledge of SOF planning required.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo determination of results. Probability tables and translations are based on "professional judgment," but can be edited to reflect statistical values.

Sidedness: One-sided, symmetric, reactive. Will represent either RED or BLUE. Can be operated by one operator.

LIMITATIONS: Requires a manual interface when used with other exercise drivers such as JESS and JTLS.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The model has just gone through a major upgrade. Future enhancements include a possible interface with other simulation models.

INPUT: SOF mission planning factors.

OUTPUT: Computer printouts of the probability of possible results or a single set of possible results. Results are coordinated with the primary exercise driver/classified scenario and appropriate message traffic provided to the exercise participants.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on any IBM PC/XT or compatible, any monitor, and adapter.
Storage:	One floppy, or one floppy and one hard drive.
Peripherals:	One printer required.
Language:	Borland Turbo Pascal.
Documentation:	A user's manual is available.

SECURITY CLASSIFICATION: Unclassified, but a tailored exercise data base may require classification.

GENERAL DATA:

Date Implemented: 1989.

Data Base: A generic data base is used, and is easily edited to meet specific requirements.

CPU time per Cycle: Very rapid (seconds).

Data Output Analysis: Manual.

Frequency of Use: Varies.

Users: Joint Warfare Center. Has been used to support USCENTCOM. The various Joint and Service schools interested in SOF staff officer training and SOF unit level staff training are potential users.

Comments: SUWAM is part of the Joint Warfare Center's SOF Simulation (SOFSIM) program, as a short-term solution to the need for an SOF simulation, until SOF can be incorporated into larger simulation models such as JESS and JTLS. Long-term use of SUWAM may be limited to unit level staff training, since it can be run on equipment normally found within the unit.

TITLE: SWARM - Strategic Warning and Response Model

MODEL TYPE: Analysis.

PROPONENT: National Test Bed/Joint Program Office, Falcon AFB, CO 80912-5000.

POINT OF CONTACT: Peter Knepell (GEODYNAMICS), NTBIC M.S. N8930, Falcon AFB, 80912-5000, (719) 380-2166.

Steven Woodcock (MMC), NTBIC M.S. N8400, Falcon AFB, 80912-5000, (719) 380-2117/3556.

PURPOSE: SWARM is a medium fidelity, end-to-end simulation of SDI systems and threats that evaluates SDI system effectiveness and supports the analysis of dynamic, time-sensitive interactions between multiple strategic layers, the loss of critical assets, and their effects on each side's offensive and defensive force structures. It is fully compatible with the October 1988 Phase I Architecture Document.

DESCRIPTION:
Domain: Air and space with limited naval (submarines); ground possible.

Span: Earth and near-Earth.

Environment: Sunlight and shadow in space or atmosphere; cloud cover; some nuclear effects.

Force Composition: ICBMs, SLBMs, Bombers, ALCMs, ASATs, SBICVs, SBLs, ERIS, HEDI, C2 Nodes, Population Centers, BSTS, SSTS, GSTS, and GBRs.

Scope of Conflict: Primarily nuclear, kinetic, and laser; SDI systems are permitted to interact in a hostile manner.

Mission Area: All SDI missions; some joint SDI-ADI analysis.

Level of Detail of Processes and Entities: SWARM is designed as several separate models linked together via a "framework." Threats are usually aggregated into "tubes," but such aggregation is not necessary. Constellations can be circular or elliptical, with any mix of phasing, inclination, or ascending nodes. Different battle management strategies can be used by each side on a per-phase basis. User-supplied asset "values" are used to prioritize both threat engagement and asset defense. True event physics are modelled to the level of detail supported by each module.

CONSTRUCTION:
Human Participation: Batch model; user required only for initial setup.

Time Processing: Dynamic, time- and event-step. Time steps to the time of the next event on the event queue, not to any uniform clock "tick." A Conflict Manager module prevents invalid or illegal event transactions.

Treatment of Randomness: Stochastic, Monte Carlo. Most kills evaluated during some form of probability of kill.

Sidedness: Two-sided, symmetrical (sometimes referred to as "four-sided").

LIMITATIONS: None intrinsic to the model structure or philosophy. Communications not currently modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Release 4.00 is tenatively scheduled for early spring of 1989. Upgrades to include further enhancements to the sensor model; introduction of fighters and patrolling aircraft; expanded nuclear effects; incorporation of a communications model; links to the NTB CUI environment; and rehosting to NTB Cray-2 and Sun 4/60 workstations.

INPUT: Menuing front-end used for most scenario data entry. Threat tracks provided by external sources or generated internally by SWARM. Preprocessing utilities help user create scenarios, especially in ASAT attack planning.

OUTPUT: STATS postprocessing utility can provide details on weapon usage and wastage by phase, assets destroyed or surviving, system "leakage" by phase, etc. Use of RS/1, a package from BBN Software available on SUN workstations, provides more detailed statistical analysis.

HARDWARE AND SOFTWARE:

Computer:	Currently on Elxsi 6400 running Embos and Cray-2 running Unicos.
Storage:	Memory: 10 MB. Disk Space: 5-15 MB (per scenario).
Peripherals:	One VT-100 (or compatible) terminal, one printer, and one SUN workstation.
Language:	FORTRAN 77 with 55,000 LOC.
Documentation:	User and operations manuals available now. Programmer and technical reference manuals are being developed and should be released with Version 4.00.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: March 1985 (initiated), December 1988 (Version 3.90).

Data Base: About three man-days for initial scenario generation and data base population.

CPU time per Cycle: Depends on data base size; on the Elxsi, the TSCB-1 scenario runs in nine minutes. Deaggregated threats can take hours.

Data Output Analysis: Some postprocessor analysis; hard copies available.

Frequency of Use: Used almost constantly. Has supported several NTB/SDIO studies into the Phase One Architecture's survivability and effectiveness.

Users: NTB/JPO, POPMO, SDIO Innovative Achitectures Office, Martin Marietta SDI Architecture Study, Martin Marietta SABIR Program, Geodynamics, MITRE.

Comments: SWARM configuration management is controlled via NTB Quality Assurance. It is continually upgraded and enhanced, primarily in response to user needs. It was designed to be a fully two-sided, modular simulation of full strategic triad. Every asset type and object function has a separate modular representation and can be represented at multiple levels of fidelity.

TITLE: SWATEM - Small-Force Weapons and Tactics Evaluation Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Ballistic Research Laboratory (USABRL), Aberdeen Proving Ground, MD 21005-5066.

POINT OF CONTACT: Dr. Joseph K. Wald, AV 298-6669.

PURPOSE: SWATEM is a research and evaluation tool that simulates a battle between two small heterogeneous groups of opposing forces. There is a maximum of 10 "game pieces" and 4 different kinds of weapon systems per side. SWATEM was developed to simulate a battle between "pop-up" attack helicopters and air defense systems protecting elements of the maneuver force, but is not limited to this scenario.

DESCRIPTION:

Domain: Land and air (hovering helicopters).

Span: Individual and local (one-on-one and few-on-few).

Environment: Statistical terrain, day and night, and a variety of weather conditions.

Force Composition: Combined arms (principally armor, air defense, and helicopters).

Scope of Conflict: Conventional.

Mission Area: Close combat with helicopters and air defense.

Level of Detail of Processes and Entities: Individual weapon systems are the entities modeled. Model stresses timeline interaction between opposing weapon systems. Detection, unmask and remask, target prioritization, handoff, weapon selection, flyout, intercept, and damage assessment are modeled.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Weapon systems move only while under mask.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Intrinsic weapon system characteristics, interactive weapon system characteristics, and tactics and rules of engagement.

OUTPUT: Killer and victim scoreboards, ammunition expenditure, optional graphics (battlefield "snapshots" of game in progress).

HARDWARE AND SOFTWARE:

Computer:	Cray 2/UNIX.
Storage:	Approximately 300,000 bytes needed at run time.
Peripherals:	1 (graphics) terminal, 1 line printer.
Language:	FORTRAN.
Documentation:	U.S. Army Materiel Systems Analysis Activity Technical Report No. 437: The Small-Force Weapons And Tactics Evaluation Model (SWATEM); user's manual in preparation.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: No formal data base. Approximately one day is required to physically assemble a runstream.

CPU time per Cycle: Typically less than 10 seconds per Monte Carlo replication.

Data Output Analysis: No postprocessing required.

Frequency of Use: Used annually for large studies lasting from three to six months.

Users: U.S. Army Ballistic Research Laboratory (USABRL) and U.S. Army Materiel Systems Analysis Activity (USAMSAA).

Comments: Input data comes from a variety of one-on-one "item-level" models.

TITLE: TACAP - Tactical Air Command Aircraft Profiler

MODEL TYPE: Analysis (Operation Support Tool).

PROPONENT: TAC/DOXD.

POINT OF CONTACT: Mel Estes, AFCSA/SAGF, 697-5616 or Ann Brown, 1912th CSGP/DOPO, AV 574-3543.

PURPOSE: The TACAP model is a computer program that provides users with a fast and flexible tool for developing information for refuelable, tactical aircraft. This model simulates the flight of an aircraft cell by computing fuel consumed and time and distance between checkpoints as well as by generating aerial refueling points and corresponding abort routes while giving consideration to climbs, descents, climatological effects, and changes in tanker/receiver ratios en route.

DESCRIPTION:

Domain: Air.

Span: Global.

Environment: Weather and geography.

Force Composition: Can consider selected Air Force, Naval, or Marine aircraft.

Scope of Conflict: Primarily an aircraft deployment model.

Mission Area: Deployment of tactical forces.

Level of Detail of Processes and Entities: Individual aircraft operating in flights during deployment or movement.

CONSTRUCTION:

Human Participation: Required to describe the flight parameters including type of aircraft; number of aircraft; route including departure, en route abort bases, destination base, and alternate airfields; altitudes; weather; and tanker/receiver ratios. Once these input parameters are set, further human participation is not required for the excursion.

Time Processing: Dynamic; time starts at aircraft departure and is reported in hours and minutes throughout the flight as time since departure.

Treatment of Randomness: Deterministic; develops calculations based on algorithms and data.

Sidedness: One-sided.

LIMITATIONS: Limited to exact aircraft and configuration contained in the data base.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Feasibility study in progress to adapt program for use in PCs.

INPUT: See Human Participation.

OUTPUT: Computer printouts listing route, times of events, aerial refueling information, and en route abort bases for individual aircraft.

HARDWARE AND SOFTWARE:

Computer:	Honeywell 6000 (WWMCCS) - GECOS 8.
Storage:	55K.
Peripherals:	Printer.
Language:	COBOL/FORTRAN 74.
Documentation:	Maintained at 1912th CSGP/DOPO; Langley AFB, VA 23665.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1974.

Data Base: Requires four to six hours to install a new aircraft type into the data base. Requires one to two hours to construct a route structure. Requires less than one hour to devise a JCL for a batch run.

CPU time per Cycle: 0.6 minutes.

Data Output Analysis: Offline.

Frequency of Use: About 500-1000 runs per year.

Users: AFCSA, HQ TAC/DOXD and 2ADG/DON.

Comments: Standalone program--output formatted to serve as input to other selected models.

TITLE: TAC Brawler

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA), The Pentagon, Washington, DC 20330-5420.

POINT OF CONTACT: LTC Richard W. Storer or Joe Tessmer, (202) 697-5677, AV 227-5677.

PURPOSE: TAC Brawler is both a research and evaluation tool and an operation support tool (decision aid). The model represents the effects of hardware and tactics on air-to-air combat at the flight-versus-flight level. Each aircraft, avionics system, and missile is explicitly represented in the simulation.

DESCRIPTION:

Domain: Air.

Span: Local.

Environment: Smooth earth, no terrain, up to 10 cloud layers.

Force Composition: Component.

Scope of Conflict: Conventional air-to-air combat.

Mission Area: Virtually any combination of current or proposed air-to-air weapon systems to include airframes, engines, missiles, guns, and avionics.

Level of Detail of Processes and Entities: Individual aircraft and weapon systems.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Current compiled version limits the total number of aircraft to 22. Upon recompiling, this limit may be raised.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Identified areas of improvement include all aspect gun employment; thrust vectoring and reversal; weapon selection algorithms; tactics selection by flight; energy management; preprogrammed maneuvers; avionics and sensor fusion; anti-radiation missiles; menu-driven input; random access history files; graphics; missile launch and approach warning devices; time sharing of the radar aperture for passive, monopulsed, and low probability of interception modes; system integration and passive operations for two or more color IR search and track seekers; multimode missile seekers; one or more pulsed motor rockets; and ducted rockets.

INPUT: Airframe aerodynamics data, avionics data, RCS data, engine data, scenario files, and rules files.

OUTPUT: Computer printouts that include input data, output variables, exchange ratio, fractional exchange ratio, number killed, method of kill, statistically analyzed data, and graphics data of each combat engagement.

HARDWARE AND SOFTWARE:

Computer:	Model currently runs on UNIX based systems, IBM mainframes, and VAX systems.
Storage:	55 MB.
Peripherals:	Printers, color graphics plotter, and color graphics monitor.
Language:	FORTRAN.
Documentation:	Extensively documented with analyst manual, user manual, and programmer manuals.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: 1976.

Data Base: Supplied with model.

CPU time per Cycle: 15 minutes to 6 hours per cycle depending on the computer used and the complexity of the scenario.

Data Output Analysis: Measures of performance runs.

Frequency of Use: Daily.

Users: AFCSA, ASK, HQ FTD, HQ TAC, AFOTED, Naval Weapons Center, General Dynamics, Grumman Aerospace, Lockheed, Northrop, Rockwell, Westinghouse, General Electric, Martin Marietta, Hughes Aircraft, Rand, Boeing, Raytheon, and LTVAPG.

Comments: None.

TITLE: TACEM - Tactical Aircraft Engagement Model

MODEL TYPE: Analysis.

PROPONENT: The BDM Corporation, 7915 Jones Branch Drive, McLean, VA 22102.

POINT OF CONTACT: Steve Verna, (703) 848-6373 or John Chalecky, (703) 848-6374.

PURPOSE: TACEM is a many-on-many model designed to evaluate aircraft survivability in a surface-to-air threat environment.

DESCRIPTION:

Domain: Primarily land although ship-based air defenses may be portrayed.

Span: Regional; size of scenario limited only by dimension statements in code.

Environment: Considers terrain masking, day, night, and weather in determining the ability of the air defense systems to detect, prosecute, and intercept the aircraft in a scenario.

Force Composition: Relevant components of BLUE and RED air and air defense forces.

Scope of Conflict: Considers surface-to-air missiles and anti-aircraft artillery.

Mission Area: Any mission area in which aircraft may be engaged by surface-to-air threats.

Level of Detail of Processes and Entities: Model entities are individual aircraft and surface-to-air systems. Air defense processes modeled include aircraft detection, processing, launch, flyout, and interception. Aircraft processes include normal flight, detection of radar lock, detection of missile launch, evasive maneuvering, and release of expendables.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Once line-of-sight exists between an air defense unit and an aircraft, reaction times are drawn from user-input distributions of the time to acquire, time to lockon, and time to compute firing solutions and decide to engage. Aircraft maneuver and release expendables based on Monte Carlo draws against the probability that an aircraft detects a radar lock or launch of a missile. Radar lock may be broken and missiles may be drawn off through an aircraft's use of expendables by a draw against the probability that the expendables are effective. Probability of aircraft kill (pK) is determined through Monte Carlo draw against the pK. Command and control is currently modeled through the use of a probability matrix which specifies the probability that any one air defense unit will engage an aircraft if another unit is already doing so.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Does not explicity consider air defense command, control, or communications. Does not explicitly consider air defense command, control, or communications.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Incorporation of a C3 module to handle target cueing and assignment.

INPUT: Requirements include aircraft flight paths, air defense positions and characteristics, and data describing the windows in which SAMs may engage the the aircraft in the scenario.

OUTPUT: Statistics on the number of missiles fired by each SAM, number of intercepts, and number of aircraft killed. A computer video of the scenario as it unfolds is available.

HARDWARE AND SOFTWARE:
Computer: DEC VAX (VMS).
Storage: Approximately 300KB.
Peripherals: A graphics terminal for viewing the video is required.
Language: FORTRAN.
Documentation: A user's manual is available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: August 1985.

Data Base: Approximately one man-month.

CPU time per Cycle: Depends on size of scenario.

Data Output Analysis: Raw data, summary statistics, and an exhaustive trace option are available for ease of interpretation.

Frequency of Use: As required.

Users: U.S. Air Force, USMC, OSD, Egyptian Air Force, commercial customers.

Comments: TACEM is a quick-running, easy-to-use model suitable for sensitivity and trade-off analyses.

TITLE: TACOPS II - Theater and Corps Operations and Planning Simulation II

MODEL TYPE: Training and education.

PROPONENT: U.S. Army War College (USAWC), Center for Strategic Wargaming, Carlisle Barracks, PA 17013-5050.

POINT OF CONTACT: Mr. Lee Fischbach, (717) 245-3650, AV 242-3650.

PURPOSE: TACOPS II is an educational war game simulation designed for use in a small classroom. Its primary purpose was to instruct students at the USAWC about command decision-making at the operational level of war. An update of the TACOPS model, it contains enhanced model algorithms and hardware re-hosting.

DESCRIPTION:
Domain: Land and air; no naval operations.

Span: Theater-level resolution of detail in any geographic region.

Environment: Hex-based (eight terrain types available); dynamic parameters capable of adjustable mobility factors within any hex; terrain impact on ground combat static for each hex type; roads, rivers, bridges, and obstacles modeled; functionality scales provided for greater precision; day and night factors adjust combat intensity and movement rates; the eight weather types affect mobility; weather constant throughout the theater.

Force Composition: All force types; regiment/brigade units used for level simulations; division/corps units used for highly aggregated theater-level simulations.

Scope of Conflict: Force-on-force (vice weapon system-on-weapon system) model; weapon systems aggregated as the unit combat effectiveness determinant; a modified Lanchester-squared algorithm resolves ground combat; nuclear and chemical munition implementation based on damage probabilities.

Mission Area: All conventional missions except naval operations; user can simulate air and combat support contributions, in an aggregate sense, by assigning levels of support to ground combat cr, at a higher resolution, by detailing specific missions and targets.

Level of Detail of Processes and Entities: Units (comprised of weapon systems) are the lowest entities utilized; attrition resolved at the unit level; all on-hand unit supply inventories subject to destruction through attrition; designated inventory items can also be consumed based on unit activity.

CONSTRUCTION:
Human Participation: Required for interactive decisions; model does not await player decisions.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Deterministic calculation of all unit attrition and the subsequent destruction of unit's on-hand supply items. The designer can choose to apply randomness as a linear function of attrition. All other processes are deterministic.

Sidedness: Two-sided, symmetric (RED and BLUE sides); other entities can be interjected by design but must be a subset of either team.

LIMITATIONS: Model is highly aggregated and not conducive to analyses of weapon attrition, weapon system contribution and effectiveness, etc. C3, naval, and air defense operations are not represented.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None envisioned.

INPUT: Terrain characteristics; unit capabilities and weapons loads; theater stock inventories, deliveries, and characteristics; and parameters affecting mobility, attrition, output generation, etc.

OUTPUT: Users can use all output immediately. Tabular and line item output reflects all pertinent results of unit movement, combat, air, logistics, intelligence, and combat support operations.

HARDWARE AND SOFTWARE:

Computer:	INTEL 310 microcomputer using the XENIX operating system.
Storage:	Requires 1 MB random access memory and up to 25 MB hard disk space.
Peripherals:	One master terminal (for scenario initiation) and a terminal and a printer for each team.
Language:	Model written in "C"; scenario development process uses the INFORMIX Relational Data Base Management System.
Documentation:	Game Director's Guide; source code and pseudocode available.

SECURITY CLASSIFICATION: Model is unclassified; data base classification is based on scenario design.

GENERAL DATA:

Date Implemented: December 1987.

Data Base: Up to several man-months, including data base input, testing, and validation.

CPU time per Cycle: Capable of reaching speeds of 50:1 (game time to real time); totally dependent on data base size (level of detail), number of orders being processed, quantity of reports generated, etc.

Data Output Analysis: N/A.

Frequency of Use: Used in support of the 1988 USAWC curriculum.

Users: N/A.

Comments: TACOPS II is solely an educational model. Due to a change in focus of the USAWC, use of the model has been suspended.

TITLE: TAC RANGER

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses, The Pentagon, Washington, DC 20330-5420.

POINT OF CONTACT: Maj Mark Olson, (202) 694-4247, AV 694-4247.

PURPOSE: The TAC RANGER program is used in weapons system effectiveness studies to estimate range, loiter time, and payload capabilities for various combat aircraft and various missions.

DESCRIPTION:

Domain: Air.

Span: Individual.

Environment: N/A.

Force Composition: Single element.

Scope of Conflict: All types of aircraft ordnance.

Mission Area: Counter air, interdiction, close air support.

Level of Detail of Processes and Entities: Individual aircraft. Movement (range and radius of operations), loiter time, and changes in aircraft gross weight and drag due to fuel expenditure and weapons delivery.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Dynamic in its use of time, distance, and rate computations to determine aircraft ranges and mission durations.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: The model has not been actively maintained, some modifications to the original model have not been adequately documented, and there is poor user interface.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Port to SUN minicomputer and PC-compatible microcomputer. Improved user interface.

INPUT: Detailed aerodynamic description of aircraft, aircraft weapon loads, and mission profiles.

OUTPUT: Aircraft flight time, weight, fuel, range, altitude, true airspeed, and fuel flow at mission phase points.

HARDWARE AND SOFTWARE:

Computer: IBM 3081 (MVS).
Storage: 100 bytes of core.
Peripherals: N/A.
Language: FORTRAN IV.
Documentation: Analysts' Manual, Vol. 1, Users' Manual & Program Description, Vol. 2.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1978-1979.

Data Base: Preparation requires one day per aircraft type, two hours per mission and payload.

CPU time per Cycle: 20 seconds per mission.

Data Output Analysis: Minimal time required.

Frequency of Use: Monthly.

Users: AFCSA/SAGF.

Comments: None.

TITLE: TAC REPELLER

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SAGF), The Pentagon, Washington, DC 20330-5420.

POINT OF CONTACT: Maj R. J. Lutz, (202) 694-4247, AV 224-4247

PURPOSE: TAC REPELLER investigates the attrition of BLUE aircraft by RED ground-based air defense systems including ADA and radar and IR-guided SAMs. Outputs are used in aircraft weapon system analysis studies.

DESCRIPTION:

Domain: Air and la...

Span: Regional.

Environment: Terrain relief, day/night, weather.

Force Composition: Air component versus air defense component.

Scope of Conflict: Conventional.

Mission Area: Tactical.

Level of Detail of Processes and Entities: Entity: Single aircraft versus single air defense site. Processes: Attrition, communications, and movement.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step model.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Number of players limited.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Aircraft characteristics such as dimensions, RCS, and IR signatures; position data for radars and fire units; individual aircraft flight paths, position, velocity, and orientation; and detection radar parameters, power, frequency, sweep rate, S/N threshold for detection, and antenna gain pattern. Terrain data as seen from viewpoints; threat prioritization parameters; command structure; target selection parameter; ammo stocks, and reload times; jammer characteristics such as power, frequency, bandwidth, and gain pattern; countermeasures equipment including jammer and flares carried by individual aircraft; and suppression attacks to be launched by a particular aircraft with an associated probability of kill.

OUTPUT: N/A.

HARDWARE AND SOFTWARE:
- Computer: IBM 3081 (MVS), CDC Cyber 176.
- Storage: N/A.
- Peripherals: N/A.
- Language: FORTRAN 88
- Documentation: N/A.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: 1985.

Data Base: 1-2 weeks.

CPU time per Cycle: 30 minutes.

Data Output Analysis: N/A.

Frequency of Use: Anually.

Users: AFCSA/SAGF.

Comments: None.

TITLE: TAC SABER

MODEL TYPE: Analysis.

PROPONENT: AD/ENYW, Eglin AFB, FL 32542-5000.

POINT OF CONTACT: Kline Bentley, (904) 882-4457.

PURPOSE: SABER is one of two main models used to support the Nonnuclear Consumables Annual Analysis and Nonnuclear Armament Plan. SABER calculates SSPD for various numbers of aircraft, weapon, and target combinations using several different delivery and weather conditions.

DESCRIPTION:
Domain: Land, air, and limited sea.

Span: Theater.

Environment: Visual/radar and guided weapon deliveries.

Force Composition: BLUE weapons vs. RED targets.

Scope of Conflict: Conventional weapons.

Mission Area: Surface targets, conventional weapons, and tactical maneuvers.

Level of Detail of Processes and Entities: SSPDs for homogeneous targets.

CONSTRUCTION:
Human Participation: Not required beyond preparation of input data.

Time Processing: Static.

Treatment of Randomness: Deterministic (no randomness).

Sidedness: One-sided.

LIMITATIONS: Does not model same smart weapons, mines, or chemical weapons.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Addition of airfield runway targets and pattern calculations for modern dispenser weapons.

INPUT: Launch conditions, delivery accuracy, weapon effectiveness and reliabilities, and target dimensions.

OUTPUT: Printouts of SSPDs for all aircraft, weapon, and target combinations.

HARDWARE AND SOFTWARE:

Computer:	Runs on CDC CYBER.
Storage:	150K bytes.
Peripherals:	Printer.
Language:	FORTRAN.

Documentation: Limited copies of user manuals available; mathematical methods documented in JMEMS.

SECURITY CLASSIFICATION: Unclassified, but data base is classified.

GENERAL DATA:

Date Implemented: 1985.

Data Base: Large data base requiring periodic revisions.

CPU Time per Cycle: Dependent on number of aircraft, weapon, and target combinations being run.

Data Output Analysis: Output is primary input to TAC SELECTOR model that adds attrition data, calculates expected kills over length of war, and sorts results into best weapon list.

Frequency of Use: Used yearly by those listed below (several runs are required for different theaters).

Users: AF/XOXF and AD/XR.

Comments: Managed by AD/ENYW, Eglin AFB, FL.

TITLE: TAC SELECTOR

MODEL TYPE: Analysis.

PROPONENT: AD/ENYW, Eglin AFB, FL 32442-5000.

POINT OF CONTACT: Kline Bentley (904) 882-4457.

PURPOSE: SELECTOR is one of two main models used to support the Nonnuclear Consumables Annual Analysis and Nonnuclear Armament Plan. SELECTOR applies attrition to SSPDs calculated by the SABER model, computes expected kills over the length of the war, and sorts a best weapon list.

DESCRIPTION:

Domain: Land, air, and limited sea.

Span: Theater.

Environment: Conventional weapons effectiveness against surface targets.

Force Composition: BLUE weapons vs. RED targets.

Scope of Conflict: Conventional weapons only.

Mission Area: To establish war reserve material requirements for conventional weapons.

Level of Detail of Processes and Entities: Individual, conventional weapon effectiveness.

CONSTRUCTION:

Human Participation: Not required except to prepare input parameters.

Time Processing: Static model.

Treatment of Randomness: Deterministic (no randomness).

Sidedness: One-sided.

LIMITATIONS: Does not handle mines and chemical weapons.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None at the present time.

INPUT: SSPDs, aircraft attrition, length of war, and aircraft and weapon cost data.

OUTPUT: Computer printouts.

HARDWARE AND SOFTWARE:

Computer:	Runs on CDC CYBER.
Storage:	70K bytes.
Peripherals:	Printer.

Language: FORTRAN.
Documentation: Limited copies of user-oriented documentation are available.

SECURITY CLASSIFICATION: Model is unclassified. Input data base and output are classified.

GENERAL DATA:
Date Implemented: 1985.

Data Base: Requires periodic additions and revisions and is very large.

CPU time per Cycle: Dependent on number of aircraft, weapon, and target combinations being processed.

Data Output Analysis: Requires considerable amount of effort to organize into an acceptable weapon mix.

Frequency of Use: Used yearly by those listed below (several runs are required for different theaters).

Users: HQ AF/XOXF and AD/XR.

Comments: This model is closely related to the TAC SABER model.

TITLE: TACSIM - Tactical Simulation

MODEL TYPE: Training and education (also used as a test driver for automated tactical intelligence systems such as the All Source Analysis System being developed by the Joint Tactical Fusion Program Management Office).

PROPONENT: Commander, TRADOC, TEXCOM, ATT: ATCT-BA-SPS, Ft. Hood, TX 76544-5065.

POINT OF CONTACT: Ed Sowell, (817) 288-9517, AV 738-9517.

PURPOSE: TACSIM supports intelligence and electronic warfare (IEW) system development and testing, command post training exercises (CPX), and evaluation of IEW and command, control, and communications functions. It is the current IEW module for the Corps Battle Simulation system but can be run alone.

DESCRIPTION:

Domain: Land, sea, and air.

Span: Accommodates any theater depending on data base; several theater data bases have been completed (Southwest Asia, Central Europe, and Middle East).

Environment: TACSIM develops a battlefield scenario that portrays opposing force equipment, unit organization, and communication procedures in terms of equipment signatures that can be detected by sensors.

Force Composition: BLUE IEW sensors and RED force intelligence observables.

Scope of Conflict: Conventional missions according to IEW doctrine.

Mission Area: All IEW missions for most ground and air IEW platforms.

Level of Detail of Processes and Entities: BLUE modeled to individual sensor; RED modeled to individual equipment emissions and aggregated to the division level. BLUE sensors output intelligence reports in U.S. message text formatting (USMFT) format. These reports are of the quality and quantity expected of the resources available to U.S. commanders in wartime.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Event-step simulation in near-real time.

Treatment of Randomness: Stochastic using Monte Carlo.

Sidedness: One-sided with only RED forces modeled.

LIMITATIONS: No human intelligence is portrayed. All sensors are not modeled. The following division and corps sensors are not represented in the model: RPV and REMBASS.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Automated assistance in building the TACSIM data bases.

INPUT: Scenario data on opposing force unit strength, deployment, locations, and movement; operational characteristics of sensors; and the operational environment such as weather. Other critical scenario data is unit Table of Organization and Equipment, radar emission policies, collection management filter, and radio net structures.

OUTPUT: Can send information over AUTODIN or over point-to-point circuits (direct TACSIM circuits). Outputs intelligence reports to corps, division, MI Bde, and the CEWI Bn.

HARDWARE AND SOFTWARE:

Computer:	VAX 8250 with VMS operating system and VAX PDP 11/84 processor (can run on any VAX/VMS system).
Storage:	Eight RA-60s (Digital Equipment Corporation disk drives).
Peripherals:	Unibus expansion box, fiber optic multiplexer, four-wire audio patch panel, video terminals, laser printer, line printer.
Language:	FORTRAN.
Documentation:	Available through the Joint Tactical Fusion Program Management Office (JTFPMO), Maj. Dave Kirks, (703) 830-7607.

SECURITY CLASSIFICATION: Unclassified, but data bases are classified Top Secret-SCI.

GENERAL DATA:

Date Implemented: 1980

Data Base: Data base preparation takes approximately three to six months for a corps exercise.

CPU time per Cycle: Can run 1:1 or real time.

Data Output Analysis: N/A.

Frequency of Use: Used in CPXs and IEW equipment testing.

Users: Corps - G-2, CTOC Support Element, Tactical Support Officer. All Source Analysis Section, Analysis and Production Section, Collection Management and Dissemination Section, Air Force Liaison Officer; Division - G-2, DTOC Support Element, Tactical Support Officer, Analysis and Production Section, Collection Management and Dissemination Section, Air Force Liaison Officer; MI Bde - G-2, Technical Control and Analysis Element, Electronic Processing and Dissemination System; CWEI Battalion - Collection managers and DIV TCAE.

Comments: Managed and continually upgraded through a configuration control board made up of representatives of all users.

TITLE: TAC Thunder

MODEL TYPE: Analysis and education.

PROPONENT: Basic Model: Air Force Center for Studies and Analyses, Fighter Division, Pentagon, Washington, DC 20330-0000.

War Game: National Defense University, Wargaming and Simulation Center, Fort McNair, Washington, DC 20319-6000.

POINT OF CONTACT: Lt Col Browning (AFCSA/SAGF), (202) 697-5616, AV 257-5616. Lt Col Might (NDU/WGSC), (202) 475-2105, AV 335-2105.

PURPOSE: TAC Thunder is used to answer questions concerning forces structure and weapons system tradeoffs.

DESCRIPTION:

Domain: Land and air.

Span: Accommodates most theaters depending on the data base.

Environment: Movement is point to point. Terrain data must be chosen for each grid square. Models day and night operations. Weather can be a user-defined constant or represented using an internal weather model based on historical data for a particular season of interest. Somewhat aggregated representation of roads, rivers, and transportation barriers.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All conventional missions except amphibious operations and unconventional warfare.

Level of Detail of Processes and Entities: Ground units react to orders provided and posture based on the threat faced. Ground attrition results are deterministic and expressed as specific types of equipment destroyed. Air units are employed in small packages, the sizes of which are determined by planning rules and factors, target characteristics, and mission priorities. Air attrition is probability of kill, Monte Carlo-based producing single aircraft kills.

All air and ground operations are logistically constrained. Theater resupply is handled through a surface-based distribution system. If desired, the user can also include intratheater airlift assets and utilize and integrated surface and air distribution system. Theater resupply can be represented by user-defined daily arrival rates or explicitly modeled using the model's intertheater logistics system.

Intelligence operations are modeled based on the perceived attributes of the enemy, which are updated only when intelligence operations are conducted.

CONSTRUCTION:

Human Participation: No user intervention required for decisions. The interruptable game allows the user to make decisions, by exception, where desired.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Deterministic land attrition; stochastic air attrition, weather, air base operations, and intelligence.

Sidedness: Two-sided, reactive. Each side has symmetric capabilities, but the user defines the specific capabilities of each side. Either or both sides can be played automatically by the model.

LIMITATIONS: Ground combat representation limits use in some theaters. Most player intervention limited to air operations. Naval operations not modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Detailed intervention into ground combat. Addition of detailed rear area transportation network. Network-based combat representation. Addition of limited naval play (carrier-based air operations).

INPUT: Scenario data base. Player may intervene if desired.

OUTPUT: Status of forces and facilities, results of air and ground operations, and statistics on attrition, mission effectiveness, etc.

HARDWARE AND SOFTWARE:

Computer:	IBM, VAX, or SUN computers.
Storage:	1 to 2 MB for data base; 1 MB for program.
Peripherals:	Terminal and printer.
Language:	SIMSCRIPT II.5.
Documentation:	Complete set of published manuals.

SECURITY CLASSIFICATION: Model code is unclassified. Most data bases are secret.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Data base the size of the central region of Europe may take four to six man-months to develop.

CPU time per Cycle: Dependent on size of data base.

Data Output Analysis: Postprocessing of detailed model transactions provides user-oriented analytical output.

Frequency of Use: Varies by user. Several use the model almost constantly.

Users: AFCSA, NDU, CFC, WPC, ASD, Air Force Human Resources Laboratory.

Comments: Configuration control operates through the user group. Model enhancements normally made singly or jointly by members of this group.

TITLE: TAC Thunder Intratheater Logistics Module

MODEL TYPE: Analysis.

PROPONENT: Air Forces Center for Studies and Analyses (AFCSA/SAGF), The Pentagon, Washington, DC 20330-5420.

POINT OF CONTACT: Mr. E. Meyer, (202) 694-8157, AV 224-8157.

PURPOSE: The Intratheater Logistics Module analyzes the interaction of intratheater airlift with the air-ground war modeled in the TAC Thunder theater-level model.

DESCRIPTION:

Domain: Land, air, limited naval.

Span: Global.

Environment: The Intratheater Logistics Module models the airlift of supplies and equipment in response to the requirements generated by the ground war during a "full-scale" TAC Thunder run. The logistics functions can also be exercised in a standalone mode based on model-generated or user-input supply requirements.

Force Composition: BLUE/RED theater forces.

Scope of Conflict: Entire gamut of airlift of supplies and equipment.

Mission Area: Airlift.

Level of Detail of Processes and Entities: Individual aircraft for airlift operations.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Event-step model.

Treatment of Randomness: Stochastic.

Sidedness: Two-sided, asymmetric. Capabilities determined by data.

LIMITATIONS: The lowest level Army unit modeled is the division. Unit movements into the theater and horizontal unit movements along the "front" must be entered manually.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Description of cargo aircraft, airbases, unit equipment, and other data required for a TAC Thunder run. Supply requests also needed when module is run in a standalone mode.

OUTPUT: Data, echo reports, standard logistics reports, a transaction log, and other reports related to full-scale run.

HARDWARE AND SOFTWARE:

Computer: IBM 3081 (MVS).

Storage: Determined by the amount of data necessary to simulate the scenario and the amount of output required.

Peripherals: Normal system storage devices.

Language: SIMSCRIPT II.5.

Documentation: Standard manual available in AFCSA/SAGF and AFCSA/SAGM.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Not determined.

CPU time per Cycle: 1-2 hours per day.

Data Output Analysis: Depends on level of detail needed.

Frequency of Use: N/A.

Users: AFCSA/SAGM.

Comments: The TAC Thunder Intratheater Logistics Module was created as part of the TAC Thunder model. However each can be run individually.

TITLE: TACWAR - Tactical Warfare

MODEL TYPE: Analysis.

PROPONENT: Joint Staff, Force Structure, Resource, and Assessment Directorate (J-8), Capabilities Assessment Division (CAD), Washington, DC 20318-8000.

POINT OF CONTACT: Mr. Alan L. Broddle, (202) 695-9145/693-4348.

PURPOSE: TACWAR is primarily a research and evaluation tool, but can be used as an operation support tool. This includes force mix capabilities at an aggregated level of weapon effectiveness against targets.

DESCRIPTION:

Domain: Air and land.

Span: Theater.

Environment: Uses 12-hour time steps for conventional analysis. Terrain modeled as contiguous or noncontiguous positions with geographic intervals.

Force Composition: Joint and combined forces.

Scope of Conflict: Conventional, nuclear, and chemical.

Mission Area: Encompasses most combat missions, both air and ground within a theater. Does not explicitly represent SOF, C3I, and CS/CSSD.

Level of Detail of Processes and Entities: Ground entity level varies from company-size subunits (nuclear and chemical) up to more prevalent division-size units. Ground weapons are modeled at an aggregated level by type (i.e., U.S. tank, allied tank). Aircraft are generally modeled by aircraft type (6 US, F-16, allied F-16, FLANKER, etc.) for both ground and air. Number of types is user-defined and data dependent. Attrition process for ground based on antipotential potential (APP) process that results in killer-victim scoreboard. Attrition process for air is binomial equation based on single aircraft's PDs and PKs resulting in individual aircraft losses and sorties loss rates by mission category.

CONSTRUCTION:

Human Participation: Not required in true simulation mode but desired for decisions in interruptable mode.

Time Processing: Dynamic, time-stepped with user-defined time intervals. Currently 12-hour fixed intervals for conventional and 4-hour intervals for nuclear and chemical processes.

Treatment of Randomness: Basically deterministic.

Sidedness: Two-sided, reactive, asymmetric.

LIMITATIONS: Limited C3I, logistics, envelopment, and breakthroughs not modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: An improved supply submodel is in beta version. It models explicitly higher echelon CS/CCS units and their capabilities and values as assets and targets. A prototype munitions tracking processor, which tracks expenditures of individual pounds of select air and ground munitions, is in beta version. A data base design review for improving the INGRES TACWAR application is in progress. A graphics application for reviewing input and output is in development.

INPUT: Extensive input variables required to support model execution. These include but are not limited to force structure, theater static characteristics, terrain features, aircraft, aircraft performance values, attrition tables, supply nodes and inventories, and supply consumption rates.

OUTPUT: An exhaustive number of output tables are available; both detailed for debugging and summary for analysis.

HARDWARE AND SOFTWARE:

Computer:	VAX 8600, running VMS.
Storage:	Approximately 1.5 MB.
Peripherals:	Line printer.
Language:	FORTRAN IV/77, "C", Sun View, and NEWS.
Documentation:	User's Guide, Programmer's Maintenance Manual, Analyst's Guides, Action Officer's User's Manual.

SECURITY CLASSIFICATION: Code is unclassified. Data is often classified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: 6 months to create new data base.

CPU time per Cycle: 30 seconds.

Data Output Analysis: Produces hard copy of raw data.

Frequency of Use: Daily.

Users: CENTCOM, SAC, USF Korea, Army War College.

Comments: N/A.

TITLE: TACWARS - TACAIR Warfare Simulation

MODEL TYPE: Analysis.

PROPONENT: General Dynamics/Fort Worth, Independent Research and Development Program (Reviewed by AFOTEC, ESC, RADC, and AFWAL).

POINT OF CONTACT: Ronald Q. Jennett, (817) 763-1487.

PURPOSE: TACWARS is a high-fidelity, human-in-the-loop simulation of the interactions between an integrated attack force and sophisticated air defense system. The simulation provides insight into the influence of each element in the battle on aircraft survivability.

DESCRIPTION:

Domain: Air (land-based air defense systems).

Span: Regional; air defense units deployed to protect the area occupied by tank army.

Environment: The simulation uses the Defense Mapping Agency digital terrain data base for descriptions of the land area over which the battle takes place. All terrain and geographic features in the data base are included in the model.

Force Composition: Attacking force: Consists of fighter bombers, defense suppression aircraft, jamming support aircraft, surveillance aircraft, fighter protection, and appropriate command, control, communication and intelligence centers. Air defense: Consists of tactical surface-to-air (SAM) missile systems, antiaircraft artillery, point defense SAMs, acquisition systems, airborne interceptors and appropriate command, control, and communications systems.

Scope of Conflict: Conventional: interactions between attacking force aircraft and the air defense system.

Mission Area: Tactical air operations, electronic combat, and air defense.

Level of Detail of Processes and Entities: Models individual aircraft of the attacking force and elements of command, control, communications, and intelligence systems pertinent to the mission being simulated. Models individual elements of the air defense system from headquarters to firing battery and communication network. Capability exists to incorporate four high-fidelity, manned simulators. Simulators add human-in-the-loop at selected radar nodes, communication nodes, and aircraft.

CONSTRUCTION:

Human Participation: Human decisions and actions may be incorporated in real-time through the use of the specially configured computer workstations and laboratory simulators.

Time Processing: Time based; operates in real-time with human-in-the-loop; faster than real-time in digital model only mode.

Treatment of Randomness: Deterministic, with Monte Carlo options of some functions, e.g. scoring.

Sidedness: Two-sided, symmetric, reactive model.

LIMITATIONS: Only air defense components of the ground forces modeled.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Additional human-in-the-loop interfaces being considered. Airborne interceptor logic being enhanced.

INPUT: Parameters describing players, scenario, and rules of engagement entered through menu-driven input routines.

OUTPUT: Chronological event listing, engagement summary, cumulative probability of survival (printed listings, plotted overlays for maps, replay and freeze capability).

HARDWARE AND SOFTWARE:

Computer:	NP1, 2 Multisels, 7 Sun Workstations; UNIX.
Storage:	Four 377 Mbyte disks.
Peripherals:	Large screen display, printer, color plotter, digitizer, video disk map overlay system.
Language:	FORTRAN, "C."
Documentation:	Specification documents and internal research and development project description written. Detailed manuals being prepared.

SECURITY CLASSIFICATION: Unclassified, but can run in a classified mode.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Data base currently being generated. Menu-driven input program simplifies updates and additions.

CPU time per Cycle: Real-time in the human-in-the-loop model.

Data Output Analysis: Standard analysis routines included. User may install specially designed analysis programs.

Frequency of Use: In development.

Users: General dynamics aircraft and electronic programs.

Comments: Available for use in digital model mode by April 1989. Laboratory simulator interfaces should be completed by January 1990.

TITLE: TACWAR/STC - Tactical Warfare

MODEL TYPE: Analysis.

PROPONENT: SHAPE Technical Centre, P.O. Box 174, 2501 CD The Hague, The Netherlands.

POINT OF CONTACT: Dr. U. Candan, xx-31-70-142306, IVSN 257-2306.

PURPOSE: TACWAR is used to comprehensively analyze the interaction of conventional forces in a variety of engagements at a theater level. The model provides a balanced representation of ground and air activities in a theater.

DESCRIPTION:

Domain: Land combat, air combat, and interactions between land and air combat.

Span: Theater-level conflict with corps-level resolution. Ground forces are portrayed at brigade and division levels, but can be subsplit. Data base exists for Central Region of ACE.

Environment: Terrain is limited to three types. Movement barriers and shoulder space limitations are portrayed.

Force Composition: Ground force and air force units are represented with their actual combat equipment, aggregated by equipment type.

Scope of Conf[illegible] Conventional warfare only, but model contains modules for NBC warfare.

Mission Area: For ground units the different postures are attack, primary defense, delay, breakthrough, and hold. For aircraft the different roles are air defense, close air support, interdiction, airbase attack, and suppression of air defense.

Level of Detail of Processes and Entities: Ground forces are portrayed at brigade and division level, but can be subsplit. Air forces are portrayed at aggregated notional airbases with mission roles assigned to proportions of aircraft types. Ground force attrition is based on the potential antipotential method. Aircraft attrition is based on binomial distributed probability of kills.

CONSTRUCTION:

Human Participation: Not required, but is permitted. TACWAR has scheduled changes and is interruptable using the INGRES DBMS.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Completely automated and deterministic.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Model is only one-dimensional; ground forces cannot outflank or surround enemy forces. No explicit treatment of command and control. No naval warfare and no current mapping capability.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Input file contains terrain features, latitude and longitude for battle areas, and battle area depths and postures that set up the theater structure.

OUTPUT: Users control the amount and type of information written to files. Summarized and detailed output is available for virtually all significant calculations of the model.

HARDWARE AND SOFTWARE:

Computer:	VAX computer with VMS operating system.
Storage:	Non-INGRES: 40,000 blocks. INGRES: 100,000 blocks.
Peripherals:	Minimum requirement: one VAX terminal and one printer.
Language:	FORTRAN V and INGRES.
Documentation:	TACWAR User's Guide, Program Maintenance Manual, Data Dictionary, and TACWAR/INGRES User's Guide.

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: 2 to 3 man-months to build the data base.

CPU time per Cycle: 5 seconds/cycle (cycle = 12 hours simulated time).

Data Output Analysis: Postprocessor available to summarize output. Hard copies of selected output tables are produced.

Frequency of Use: Several times per year.

Users: SHAPE Technical Centre, OJCS, and CENTCOM.

Comments: Variations of TACWAR at each of the user sites.

TITLE: TAC Weaponeer II

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses (AFCSA/SAGF), The Pentagon, Rm 1D380, Washington, DC 20330-5420.

POINT OF CONTACT: Lt Col Ron Browning, (202) 697-5615, AV 227-5616.

PURPOSE: TAC Weaponeer II is an analysis tool used to determine the effects of air-to-surface weapons on nonhomogenous ground target sets. Results show the expected value number of kills for each type target in the set.

DESCRIPTION:
Domain: Land and air.

Span: Local.

Environment: Dynamically models the employment of air-to-surface weapons against ground targets. Weather not specifically modeled.

Force Composition: Aircraft versus one ground element. Single.

Scope of Conflict: Conventional weapons employment.

Mission Area: Ground attack.

Level of Detail of Processes and Entities: Single aircraft. Single piece equipment up to several groups of nonhomogenous target sets.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Does not currently model cluster munitions, precision-guided submunitions, or sensor-fused munitions.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Cluster munitions, precision-guided submunitions, and sensor-fused munitions.

INPUT: Weapon laydown characteristics (aircraft and munition parameters). Target positions and areas of effect.

OUTPUT: Table of expected fractional kills by type equipment.

HARDWARE AND SOFTWARE:

Computer: Sun 3/4.
Storage: 20 megabytes.
Peripherals: Mouse and workstation.
Language: FORTRAN 77 and Template.
Documentation: Analysts' manual, users' manual, and programmers' manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: 30 minutes.

CPU time per Cycle: Depends on computer, model number of munitions, number of targets, and type of targets.

Data Output Analysis: Instantaneous upon run completion.

Frequency of Use: Daily when building expected value tables.

Users: AFCSA/SAGF

Comments: None.

TITLE: TAFSM - Target Acquisition Fire Support Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Field Artillery School, Directorate of Combat Developments, Concepts, and Studies, Simulation Division, ATTN: ATSF-CCM, Fort Sill, OK, 73503-5600.

POINT OF CONTACT: Walter W. Millspaugh, (405) 351-6400, AV 639-6400.

PURPOSE: TAFSM is a research and evaluation tool used to compare competing artillery systems and analyze their relative differences such as target acquisition sensors, automated data systems, ammunition, and ammunition delivery platforms. Differences are usually measured through battlefield troop and material casualties.

DESCRIPTION:

Domain: Land.

Span: TAFSM is typically played at the U.S. Army division level. Scenarios include Central Europe and Southwest Asia.

Environment: Normally simulates a 24-hour, two-sided conflict. Units move along predetermined paths, but may be slowed by conflict or time of day. Terrain and vegetation are played statistically.

Force Composition: Combined ground forces.

Scope of Conflict: Conventional warfare with emphasis on the artillery conflict. No nuclear or chemical warfare.

Mission Area: Indirect artillery.

Level of Detail of Processes and Entities: High-resolution play of artillery sensors, C3, weapons, and ammunitions. Maneuver attrition can be played with TAFSM's internal ground game or externally with nonartillery attrition derived from the SCORES process. Entities are usually platoon-level units or individual weapons or sensors. Sensors acquire and recognize targets, which are reported to fire direction centers over explicit communications nets. Fire direction centers allocate missions to subordinate fire units and other fire direction centers. Missions are fired with conventional, improved conventional, semi-active laser-guided, or autonomous fire-and-forget smart munitions. Casualties are assessed stochastically for each artillery round against each vehicle in the impact area. The ground attrition model is an analytic, Lanchestrian representation.

CONSTRUCTION:

Human Participation: No human interaction during execution. Model may be interrupted and restarted at the beginning of any hour. Changes can be scheduled to occur at specified times.

Time Processing: Dynamic, time- and event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided.

LIMITATIONS: Does not explicitly model air or naval fires. There is limited electronic warfare, no nuclear or chemical warfare, and a limited number of scenarios. Force effectiveness affects predetermined maneuver tactics. Extensive scenario data makes new scenario implementation difficult.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Better electronic warfare, close air support, and improved intelligence fusion.

INPUT: N/A.

OUTPUT: Output from the supplied postprocessor consists of summary tables of statistics such as targets acquired, missions fired, casualties, and rounds expended.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a VAX computer with a VMS operating system. Also runs on AVALON's 80386 processor attached to a VAX.
Storage:	Model and input data storage total approximately 10,000 blocks. Output is approximately 25,000 blocks per replication.
Peripherals:	One terminal (DIGITAL VT100, VT220, or VT240) and, if hard copy is desired, one printer.
Language:	FORTRAN 77 with limited DEC extensions.
Documentation:	User's manual and a programmer's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1982.

Data Base: Several man-months to implement a new scenario. Time to build a new weapons data base depends upon number of weapons and ammunition combinations desired, but for a nominal number of weapons probably two man-months would be required to build and debug.

CPU time per Cycle: CPU time for a BLUE division-sized simulation of 24 hours of combat is about 4 hours on a VAX 11/780.

Data Output Analysis: Analysis of output tables can take from minutes to hours based upon statistics used. Analysis of the event history file produced by the simulation may take from hours to days depending upon the analysis.

Frequency of Use: Used daily at the proponent activity.

Users: Other users include the FMC Corporation, LTV Aerospace, and the Foreign Science and Technology Center.

Comments: TAFSM has been included in a report describing a soft linkage concept to tie together models in the Army Model Improvement Program.

TITLE: TAGS - Technology for the Automated Generation of Systems

MODEL TYPE: Analysis.

PROPONENT: Teledyne Brown Engineering, Cummings Research Park, M. S. 202, Huntsville, AL 35807.

POINT OF CONTACT: Gerry Gotvald, (205) 532-1613, Telefax (205) 532-1033.

PURPOSE: TAGS is an operations support tool. The TAGS tools are based on a graphical, executable system design language. From this executable specification of a real-time embedded computer system design, TAGS generates automatic discrete event simulations, automatic Ada code generation, and automatic VHDL generation (in progress).

DESCRIPTION:

Domain: Modeling of system architectures and control flow.

Span: Models real-time systems as they interface to other systems.

Environment: Models computer system data and control flow.

Force Composition: N/A.

Scope of Conflict: Models systems containing real-time embedded computers including BM/C3 functions.

Mission Area: Primarily conventional missions.

Level of Detail of Processes and Entities: The TAGS simulation blueprint allows a mixture of fidelity of subsystem or function components within the same system model patterned after the stepwise refinement human learning process. Analytic models can be combined with functional or probabilistic models.

CONSTRUCTION:

Human Participation: Active user participation may be incorporated in the simulation.

Time Processing: Dynamic I/O time-driven event list.

Treatment of Randomness: Components use deterministic modeling.

Sidedness: One-sided centralized simulation exercised by a single operator at this time. Could be expanded for distributed simulation.

LIMITATIONS: None.

PLANNED IMPROVEMENTS AND MODIFICATIONS: "C" code generation; rehosting to SUN, VAX Station 2000, IBM PC RT using X windows and UNIX V.3; VHDL generation; and reverse engineering.

INPUT: Environment model or event file.

OUTPUT: Printouts and plots of execution frequencies, mathematical algorithm output, interface traffic, and timelines. POSTSCRIPT printer standard output.

HARDWARE AND SOFTWARE:

Computer:	Apollo/Aegis 9.7, SUN/OS 3.5, VAX Station 2000/ULTRIX 2-2, X Windows Version 11, and Ada compiler.
Storage:	24 MB disk space before data base installed; 4 MB minimum workstation.
Peripherals:	POSTSCRIPT printer.
Language:	"C" and Ada.
Documentation:	Extensive documentation with nine manuals.

SECURITY CLASSIFICATION: Unclassified, although data bases may be classified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Approximately one man-hour per design page in conceptual design and 1/4 man-hour per design page in V&V activities.

CPU time per Cycle: Depends on data base size and workstation memory; large runs may take several hours.

Data Output Analysis: Postprocessor utilities and plotting software packages produce hard copies for POSTSCRIPT printers.

Frequency of Use: Weekly operation.

Users: NADC, Navy-China Lake, ARMTE, AMCCOM, and NASA.

Comments: Commercially available off-the-shelf computer aided systems and software engineering environment.

TITLE: TALCCM - Tactical Airlift Control Center Model

MODEL TYPE: Analysis.

PROPONENT: Boeing Military Airplanes, Operations Analysis, Box 7730, M/S K80-33, Wichita, KS 67277-7730.

POINT OF CONTACT: Jeffrey T. Hunt, (316) 526-2956.

PURPOSE: TALCCM simulates the operation of a tactical airlift control center. It was specifically designed for analyzing airlifter fleet mixes in a theater. It was also designed to be the nucleus for the development of a decision support system that could be used in actual tactical airlift control centers.

DESCRIPTION:

Domain: Land and air.

Span: Theater of operations.

Environment: Altitude, distances, and temperatures.

Force Composition: Tactical transport aircraft.

Scope of Conflict: Operation of a tactical airlift control center.

Mission Area: Theater airlift.

Level of Detail of Processes and Entities: Entities include individual aircraft, individual trucks to move cargo, and cargo items to be transported either by airplane or truck. The processes modeled include aircraft flight, loading and unloading of cargo, aircraft service, and movement of trucks carrying cargo items.

CONSTRUCTION:

Human Participation: Required to set up data files for execution.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Loading and unloading times are assigned based on an input mean and standard deviation. The random number generator provided the SIMAN software used by the TALCCM uses this mean and standard deviation to generate the time to be used.

Sidedness: One-sided.

LIMITATIONS: While the TALCCM considers the length, width, height, and weight of items to be delivered by aircraft, it models trucks using only the maximum weight for the cargo that may be carried by that truck. Trucks are also assumed to travel at a constant speed between all points. Aircraft fly at a predetermined altitude on all flights, but the TALCCM may be expanded to include flight at multiple altitudes in the future.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Inclusion of threats in the theater and aircraft survivability based on those threats, an ability to alter the

scenario interactively during a run or at specific times determined prior to run time, and improved preprocessing functions.

INPUT: Input files are required to provide the following information: origins and destinations of cargo on the theater (this includes things such as latitude, longitude, elevation, runway length, LCN, MOG, etc.); aircraft data (this includes cargo box dimensions, performance data, etc.); aircraft beddown data; job definition data (origin and destination of jobs, list of items to be moved including dimensions of all items, generation time of the job, priority of job, etc.); and ground transportation network data (optional).

OUTPUT: Output includes a scheduling report with all schedulings of deliveries, reschedulings of deliveries to accommodate higher priority jobs, movement of ground vehicles, and airdrop of jobs. Summary reports calculate statistics on aircraft use and job deliveries.

HARDWARE AND SOFTWARE:

Computer:	Developed to run in a network of APOLLO DN3000 and DN660 terminals running an AEGIS-DOMAIN/IX (Unix-based) operating system, software release 9.5.
Storage:	About 600K for the executable model. Data bases may require considerable additional space.
Peripherals:	One printer and one terminal.
Language:	APOLLO/DOMAIN FORTRAN, SIMAN (Simulation Analysis Language by Systems Modeling Corp.), APOLLO DOMAIN/IX operating system calls, and TRIRIM data base management system that makes calls to Boeing Military Airplanes' Aircraft Data Base.
Documentation:	A testing and verification document and a draft of a preliminary management summary manual are available.

SECURITY CLASSIFICATION: Unclassified, but data could be classified.

GENERAL DATA:
Date Implemented: 1987.

Data Base: Development of data bases could take a considerable amount of time. We have several sets of scenario data modified from the Generalized Air Mobility Model.

CPU time per Cycle: On our hardware, small scenarios may take overnight while large scenarios may run for for several days.

Data Output Analysis: Output summary reports provide a considerable amount of summary data. The scheduling report can be used to verify actual schedulings and deliveries made during the run.

Frequency of Use: Several times a year for airlift analyses.

Users: Boeing Military Airplanes, Operations Analysis, and Tanker/Airlift Program Support.

Comments: None.

TITLE: TAM - Theater Analysis Model

MODEL TYPE: Analysis (neither a decision maker nor an exercise driver).

PROPONENT: Force Structure, Resource, and Assessment Directorate (J-8), The Joint Staff, The Pentagon, Room BC942, Washington, DC 20318-8000.

POINT OF CONTACT: LTC David G. Boyd, CDR David K. Meier, (202) 697-9860, AV 227-9860.

PURPOSE: TAM provides the results of military conflict incidental to the conduct of politico-military games. It deals with force capabilities and requirements and provides a foundation for players to assess courses of action and resource planning.

DESCRIPTION:

Domain: Land, sea, and air.

Span: Global, theater, regional, or local.

Environment: Does not model geography but does consider terrain relief, weather, time of day, sea states, and underwater acoustic conditions.

Force Composition: Any mix of forces, BLUE or RED.

Scope of Conflict: All conventional warfare missions.

Mission Area: N/A.

Level of Detail of Processes and Entities: Ground warfare is modeled most effectively at the brigade level and above. Air and naval warfare modeled at an individual level of detail (aircraft and ships). Any number of levels can be represented in the same data base. All attrition results are stochastic and are provided down to the lowest level employed in the data base.

CONSTRUCTION:

Human Participation: Required for operational decisions and processes.

Time Processing: Dynamic, time-step and event-step. Progresses through game moves at a user-specified ratio of exercise time to real time.

Treatment of Randomness: Land attrition is based on a randomly generated entry point to a table of expected values. Air and sea attrition based on direct computation of probability of detection and kill with stochastic determination of results.

Sidedness: Two-sided, symmetric. Can be tested by a single operator and operated by any number of players.

LIMITATIONS: Does not model geography, nuclear or chemical warfare, or unconventional warfare.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Model is being enhanced on a continuing basis. Nuclear and chemical warfare are being added, resource

assessment capabilities are being improved, and postprocessing reports are being added.

INPUT: Relevant units, weapons, movement, attrition tables, weather, and terrain.

OUTPUT: Printout of movement and attrition as well as detailed data that can be used to document intelligence and logistics.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on any MS DOS-compatible computer. Runs best on 80286 or later generation processor, and requires a math coprocessor chip and a minimum of 640K RAM.
Storage:	Requires a minimum of 10 MB.
Peripherals:	1 printer.
Language:	Ada.
Documentation:	Limited; under development.

SECURITY CLASSIFICATION: Unclassified, but data bases are classified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Population of large data bases can take several man-months to assemble.

CPU time per Cycle: Depends on data base size, player configuration, and processor used. On a typical 80286 processor, a large exercise may require 10-30 minutes run time.

Data Output Analysis: Postprocessor aids in analysis. Model produces hard copy of raw data.

Frequency of Use: As required.

Users: Politico-Military Simulation and Assessment Division, J-8 to support Joint Staff Politico-Military game requirements such as CINC's Wargame and NATO CHODS Crisis Response Seminar.

Comments: N/A.

TITLE: Tank Wars II - The Sustained Combat Model

MODEL TYPE: Analysis.

PROPONENT: Ballistic Research Laboratory (BRL), Aberdeen Proving Ground, MD 21005.

POINT OF CONTACT: Fred Bunn, (301) 278-6648, AV 298-6648.

PURPOSE: Tank Wars is used to evaluate materiel. It was initially designed to evaluate the combat effectiveness of M tanks versus N threat tanks. It has since been extended to evaluate systems firing of TOW, HVM, and STAFF. It has been used extensively to evaluate entire new armored combat vehicle concepts, as well as trade-offs involved in new subsystems.

DESCRIPTION:

Domain: Land.

Span: Local (approximately 10 combatants per side).

Environment: Statistical in-view/out-of-view segment lengths, smoke, and full defilade/hull defilade/fully exposed.

Force Composition: M identical BLUE weapons versus N identical RED weapons.

Scope of Conflict: Conventional at forward area with engagements, RED attack, and BLUE attack.

Mission Area: Direct attack.

Level of Detail of Processes and Entities: Models smoke or terrain via in-view/out-of-view segment lengths using appear, vanish, and hide events. Model acquisition of partially exposed and fully exposed, moving or stationary targets plus system motion via brake, halt, accelerate, and cruise events as well as pop-down and pop-up. Models firing of guns and missiles (including firing of several missiles almost simultaneously from a single platform at several targets) using a fire event. Models direct or top attack, target-switching policies, and hit/miss on 3-dimensional hull and turret via impact and disengage events. Models mobility, firepower, and catastrophic kills via damage, abort (missile), and other events.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step (time-step for search).

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, both sides reactive.

LIMITATIONS: Does not use digitized terrain. Cannot handle smoke and terrain simultaneously. Does not yet play bounding overwatch or planned withdrawals to subsequent prepared defensive positions. Does not yet play pop-up, shoot a few, pop-down, and repeat except for systems with missile pods. Does not yet

play fractional loss of function. Game continues until one side can no longer fight; it may be more realistic to fight until attacker loses 30% or defender loses 50%. Only one weapon is modeled per vehicle. All weapons on a side are identical.

PLANNED IMPROVEMENTS AND MODIFICATIONS: See limitations above.

INPUT: BRL IUA lethality data, AMSAA accuracy data, miscellaneous data describing system dimensions, search, fire cycle, motion, and weapon use.

OUTPUT: Probability BLUE or RED wins, exchange ratios, ammo consumption, etc. Each event in an engagement can be printed.

HARDWARE AND SOFTWARE:

Computer:	PCs to supercomputers.
Storage:	256 KB.
Peripherals:	Printer.
Language:	FORTRAN 77.
Documentation:	Old user's manual is obsolete; new user's manual is in final draft.

SECURITY CLASSIFICATION: Program is unclassified. Input and output may be classified.

GENERAL DATA:

Date Implemented: January 1984.

Data Base: Two weeks for data acquisition, one day for data preparation.

CPU time per Cycle: Clock time for 3 scenarios with 6 opening ranges and 1000 replications per case - 24 hours on PC, 3 hours on mid-sized computer, and 5 minutes on supercomputer (depends on number of users).

Data Output Analysis: One day.

Frequency of Use: 500 runs per year.

Users: BRL, AMSAA, ARDEC, RARDE (UK), Denmark, LTV, General Dynamics, General Defense, LTV Corp, Honeywell, Booz Allen, Rockwell, bootleggers.

Comments: Can be distributed to qualified users on magnetic tape but prefer to use IBM compatible floppy. Distributed with five test cases. Depending on circumstances, POC may be available to assist in implementation. Classified input data must be obtained independently.

TITLE: TAPM - Tactical Aircraft Penetration Model (Flight Path Optimizer)

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies & Analysis (AFCSA/SAGF), The Pentagon, Washington, DC 20330-5420.

POINT OF CONTACT: Capt Jeff Sedlak, (202) 694-4247, AV 224-4247.

PURPOSE: TAPM is used to generate optimum (minimum attrition) ingress and egress flight paths which can be used by attrition models such as ESAMS and TAC REPELLER. The resulting attrition figures can be used in weapons system effectiveness studies.

DESCRIPTION:

Domain: Land and air.

Span: Regional.

Environment: Weather and terrain relief.

Force Composition: Individual aircraft or a small formation of aircraft against enemy air defense components.

Scope of Conflict: Conventional.

Mission Area: Interdiction.

Level of Detail of Processes and Entities: Entity: Individual aircraft and individual air defensive units. Processes: Movement of aircraft, attrition.

CONSTRUCTION:

Human Participation: N/A.

Time Processing: Dynamic.

Treatment of Randomness: Deterministic.

Sidedness: N/A.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Updated documentation and contracted model support (awaiting funding).

INPUT: For any new missile system, its corresponding ESAMS missile model and associated data base must be included. The user provides scenario data by means of a user-friendly, menu-driven interface. In addition, terrain and weather data bases are required if these effects are to be included. BLUEMAX II aerodynamic and propulsion data bases are also required.

OUTPUT: A file containing flight path points for every 1/2 second of flight. This file is in a form suitable for use by ESAMS and TAC REPELLER. Cumulative Pk is also given. A graphics capability is provided to show the scenario, threat value distributions, terrain contours, and flight path information.

HARDWARE AND SOFTWARE:

Computer: IBM 3081 (MVS), Honeywell (MULTICS).
Storage: N/A.
Peripherals: N/A.
Language: FORTRAN 77.
Documentation: Documentation is available in AFCSA/SAGF.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1983 - 1984.

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: Has not been used for several years.

Users: AFCSA/SAGF.

Comments: Contains an imbedded BLUEMAX II flight path generator.

TITLE: TARA - Target Acquisition and Risk Assessment

MODEL TYPE: Analysis.

PROPONENT: BDM Corporation, 7915 Jones Branch Drive, McLean, VA 22102.

POINT OF CONTACT: William T. Cooper, (703) 848-7510 or Robert H. Sharify, (703) 848-6025.

PURPOSE: TARA is used primarily to evaluate the risk to units or force elements, which can assume various postures, in terms of the likelihood of detection and attack (conventional, nuclear, or chemical) by opposing forces. The model also assesses measures for altering that risk.

DESCRIPTION:
Domain: Friendly forces: land.
Enemy sensor systems: land and air.

Span: Accommodates up to regional brigade deployment.

Environment: Digitized terrain is in 100m x 100m blocks that include elevation and relative density.

Force Composition: BLUE - brigade scenario postures.
RED - sensor system dispersal.

Scope of Conflict: Primarily detection and verification by enemy systems, but effects by conventional, chemical, and nuclear attack after targeting are also analyzed.

Mission Area: All land-based brigade deployment within 400 km of the FLOT.

Level of Detail of Processes and Entities: All detection and targeting results, based on individual company activity location, composition, and lucrativeness factors, can be displayed for each company or for battalions (composed of up to six companies). All units final detection results are broken down to percent of detection by each sensor system within LOS or within range.

CONSTRUCTION:
Human Participation: The model depends on battalion, sensor, and terrain data bases for all input, but the user may specify particular data bases and scenarios before the model is run. User-friendly interactive updates of the data bases are possible before and after a run is completed. Due to the fast run completion time of less than five minutes, no user interruption is required.

Time Processing: Static. Each run simulates a "picture" taken of the force deployment, performing detection analysis at any given instant.

Treatment of Randomness: All detection and verification procedures are deterministic, but there is a Monte Carlo determination of targeting and attack results.

Sidedness: Two-sided, with the RED side (all sensor information) nonreactive.

LIMITATIONS: Does not investigate detection probabilities of air-based vehicles.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The model will run in conjunction with the Fulcrum Video Workstation, enabling the user to change and view any information about a force unit displayed on a screen overlaid by various maps. There will be access to each unit on screen via a mouse.

INPUT: Digitized terrain, as provided by the Defense Mapping Agency and BDM. Parameters for BLUE force units include location, activity (for all postures) and lucrativeness factors, environment coverage, company composition, priorities, and type. Parameters for RED sensors include inherent system probability of detection for each zone (1-5), types and amounts, locations, range, delay time, approximate coverage, and weather susceptibility.

OUTPUT: Produces printouts and graphs of detection, verification, targeting, and hit probabilities for each company or battalion, with and without sensor capability, for systems that contributed most to a particular company or battalion's detection, and for the top five most dangerous sensors to a unit type.

HARDWARE AND SOFTWARE:

Computer:	IBM XT, AT, PS/2 or compatible, operating with MS-DOS.
Storage:	2 MB.
Peripherals:	Printers (Fulcrum Video Workstation optional).
Language:	Pascal.
Documentation:	User's manual describing all data bases and routines, along with flowcharts, and interpretation of results.

SECURITY CLASSIFICATION: Unclassified, but data may be classified.

GENERAL DATA:

Date Implemented: 1988.

Data Base: Development in complete BLUE force unit data and RED sensor data in region specified may take a few man-weeks.

CPU time per Cycle: (Based on IBM PS/2 Model 80 system): Initialization of all data in proper format takes 30 seconds. Assigning of all unit and sensor locations needed and checking each for LOS takes 20 minutes. Run time for each scenario with all output ready takes 3 minutes.

Data Output Analysis: Postprocessor develops output into graphics-ready and raw data format.

Frequency of Use: Several times per year by the users below.

Users: DNA, FMC, BDM.

Comments: Model is easily upgraded to specifications desired. The model includes lucrativeness methodology as developed by the U.S. Army Concepts Analysis Agency.

TITLE: TAWS - Theatre Air Wargaming System

MODEL TYPE: Analysis (but also potential exercise driver and training model).

PROPONENT: SHAPE Technical Centre, P.O. Box 174, 2501 CD The Hague, The Netherlands.

POINT OF CONTACT: Mr. B. R. Witherden, 070-142303, IVSN 257-2303.

PURPOSE: TAWS is a research and evaluation tool that deals primarily with combat development. It can be used to study competing strategies or the effects of current or new doctrines and for capability and requirements studies, particularly resource planning issues. It is being used as a exercise driver in the UK (Army Staff College).

DESCRIPTION:

Domain: Air (when integrated with IDAHEX, its domain is land and air).

Span: Accommodates any theater depending on data base. Current data bases exists for Central Region, Southern Region, and Northern Region of ACE.

Environment: Latitude and longitude geographical coordinates used but with no terrain features. Day and night operations and four weather types in a grid across the theater are modeled.

Force Composition: Air forces and air defense assets of ground forces, BLUE and RED.

Scope of Conflict: Conventional only.

Mission Area: Offensive and defensive counter-air (CAP, GLI), electronic warfare, reconnaissance, air-to-air refueling, limited offensive air support and interdiction/FOFA (unless integrated with IDAHEX), and point/area air defense (SAM, Shorad).

Level of Detail of Processes and Entities: Data base has a hierarchical structure with eight levels. Aircraft of a certain type are identical; but single aircraft missions are possible. SAMs modeled at battery level with each missile counted. Logistics counted for each sortie and accounted for at airbases. Aircraft attrition is Monte-Carlo based. Many-on-many air-to-air combat is based on Lanchester equations with dynamic dependence on force ratio as each individual aircraft is killed. Intelligence operations and information dissemination is resolved by human interaction. Degradations due to EW or in the C3 network are handled in an aggregated fashion at approximately SAM battalion level.

CONSTRUCTION:

Human Participation: Required for decisions in creating input relating to missions to be flown within a typically 6-hour game cycle. Cycle is executed without human participation or interruption.

Time Processing: Dynamic, event-step; event-driven with time resolutions of 1 minute.

Treatment of Randomness: Stochastic; attrition based on direct computation of probabilities of engagement and kill with Monte Carlo determination of result. A few areas are handled deterministically.

Sidedness: Two-sided, symmetric. Can be tested by a single operator, and typically played by two teams of five to eight players.

LIMITATIONS: No terrain features accounted for; only aircraft two altitudes; very manpower-intensive. Mission planning and input for a 6-hour cycle in Central Region takes from 4 to 8 hours.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Rule-based expert system automated mission planner for offensive missions; user-friendly input and interactive data query form-based interface using computer graphics for display and input purposes; plans to integrate with a naval model 1989-1990.

INPUT: OCA, OAS, stand-off jammer/escort jammer, reconnaissance, and positions of CAP missions; AWACS orbits; rebasings, re-rolings, and logistics movements; and SAM movements.

OUTPUT: Printed outputs with detailed documentation of all events. Postprocessor produces summary tables to help players with planning.

HARDWARE AND SOFTWARE:

Computer:	Basic program portable. When integrated with IDAHEX, need a VAX computer with VMS.
Storage:	TAWS plus satellite programs to build data base plus small unclassified test data base take 10,000 blocks (5 MB).
Peripherals:	Minimum requirements: one printer, two VT100 terminals.
Language:	FORTRAN V.
Documentation:	STC TM-812, "Theatre Air Wargaming System (TAWS)," (Volume I, Player's Manual and Volume II, Game Designers Manual).

SECURITY CLASSIFICATION: Unclassified, but data bases are often classified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: Large data base requires 6 man-months to build.

CPU time per Cycle: Depends on data base size and number of events in a cycle. Largest cycle run for Central Region took about 20 minutes CPU on VAX 8700 to process 6 hours of combat.

Data Output Analysis: Postprocessor aids in analysis of output. Hard copies of raw data are produced.

Frequency of Use: Twice a year at STC.

Users: STC; Army Staff College, Camberley, UK; USAFE/DOA; RAND Corporation; Turkish General Staff; Hellenic Army General Staff; and KMID, Brussels.

Comments: Model can be used stand-alone or integrated with IDAHEX. No official users group for TAWS exists.

TITLE: TECH/MAP - Time Evaluation of Casualty History

MODEL TYPE: Analysis.

PROPONENT: CRDEC, Studies & Analysis Office, Aberdeen Proving Ground, MD 21010-5423.

POINT OF CONTACT: Mr. C. Glenvil Whitacre, (301) 671-4241, AV 584-4241.

PURPOSE: The main purpose of this program is to generate a composite grid of output values in terms of concentration, dosage, and deposition values that represent the contamination levels achieved by firing multi-rounds into a battle area.

DESCRIPTION:

Domain: Land: flat terrain with open or wooded conditions.

Span: The target array can vary from platoon to battalion size.

Environment: In-place battlefield units under steady-state MET conditions for transport and diffusion of chemical agent.

Force Composition: Accurately evaluates either BLUE or RED target units.

Scope of Conflict: Chemical warfare.

Mission Area: Chemical battlefield missions.

Level of Detail of Processes and Entities: High resolution assessment methodology. Characterization of chemical cloud patterns and target units can be evaluated in detailed increments over space and in time. Single munition cloud patterns must be represented and input in DOSVEC form. Model then accurately simulates munition delivery process generating the coordinates of the impact points. The addictive contribution of the agent from each functioning munition is assessed at each grid point throughout the targeted and off-targeted areas where agent effects occur. The accumulated agent exposure level at each target grid point is related to an expected casualty value through a dose-response functional relationship for each cell of the sample field. These values are then calculated for the targets.

CONSTRUCTION:

Human Participation: Highly user-interactive during model execution.

Time Processing: Snapshots taken of battlefield as function of time.

Treatment of Randomness: Stochastic, Monte Carlo. Replicates impact generation and calculates expected mean and standard deviation of effects values.

Sidedness: One-sided.

LIMITATIONS: The model needs improved algorithms to access personnel degradation and casualties as well as algorithms to simulate chemical operations taking place within the battle area for evaluation of impact on unit degradation and mission effectiveness.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Extensive redesign and coding improvement are underway to develop a user-friendly PC version. A technique to include consideration of the HOB error is being incorporated, and the technique of predicting the amount of secondary vapor is being redesigned to calculate evaporation from the accumulated composite deposition grid.

INPUT: Program control indicators; location of file for single source cloud DOSVECs; agent toxicity, MET, and munition delivery error parameters; target dimensions and characteristics; aim points; and number of rounds fired.

OUTPUT: A display map of the composite concentration/dosage/deposition patterns as well as expected fractional casualties and area coverage as a function of contour levels for each target.

HARDWARE AND SOFTWARE:

Computer:	Upgraded program will be operational on IBM-compatible PCs and the UNIVAC 1100/60 systems. Current version on PC.
Storage:	Approximately 1600 lines of FORTRAN code now, but fully operational version expected to exceed 2000 lines of code.
Peripherals:	Minimum requirement: one printer.
Language:	ASCII Standard FORTRAN 77.
Documentation:	A technical report documenting the original methodology will be updated and supplemented by a user's guide for this interactive version.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: Initial program design: early 1960s.
Improved and enhanced PC and UNIVAC version: 1989.

Data Base: Collection of the munition characteristics, delivery error values as a function of range, and definition of the target arrays are the most time-consuming efforts of preparing the input data bases. Inquiries from the console screen must be answered from the keyboard. Minimum time requirements for input vary from seconds to several minutes depending on user experience and availability of data.

CPU time per Cycle: Typically one to three minutes for a complete run on the PC, but varies and increases as the simulated battlefield scenario increases in complexity.

Data Output Analysis: Results are generally used directly as they are output; postprocessor not needed to analyze the output results.

Frequency of Use: Daily to at least monthly usage anticipated within CRDEC.

Users: Currently CRDEC.

Comments: The main problem with the old "batch" processing of this methodology was the complex input technique used to simulate delivery of chemical munitions. This "new" interactive version will maintain the accuracy capabilities of the delivery process while greatly simplifying the input requirements for the user.

TITLE: TEM - Terrain Effects Model

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, ECM Advanced Development Branch (WRDC/AAWD), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. Tom Madden, (513) 255-6705.

PURPOSE: TEM is a research and evaluation tool that simulates a one-on-one terminal engagement of an airborne or ground-based monopulse threat radar, including an AAM or SAM system with its homing sensor and a penetrator. The simulation includes a technically complete representation of the theory of terrain reflectivity.

DESCRIPTION:

Domain: Land, air, and sea.

Span: Local and individual.

Environment: Terrain can be modeled using DMA DTED.

Force Composition: One-on-one engagements.

Scope of Conflict: Conventional.

Mission Area: Aircraft penetration against defense systems.

Level of Detail of Processes and Entities: The threat radar is airborne or ground-based and includes angle tracking and may include velocity tracking. The propagation and reflectivity model includes both skin and jammer returns. Multipath (specular and diffuse forward scatter) can be added to either skin or jammer signals in either the forward or the return direction. The multipath model may incorporate DMA DTED based height variations. Separate modes in the simulation can be controlled via software logical switches so that, for instance, the polarization output of a particular horn, the number of horns transmitting and receiving, or the types of reflectivity can be turned on or off to investigate the effects of antenna polarization characteristics, receiver response to particular channel components, or types of reflection from the terrain surface. The threat radar, penetrator ECM gear, penetrator skin, and propagation and reflectivity portions of the model are functionally separated. The threat radar model includes separate modules for the jammer antenna(s), jammer receiver and processor, ECM controller, and jammer transmitter jammer logics: linear cross-eye, saturated cross-eye, cross-polarization, azimuth terrain bounce, elevation terrain bounce, single axis jammer, towed repeater, or velocity gate pull-off. Other jammers, such as image cross-eye and double cross, can be simulated by using one of these types with appropriate input data. The propagation and reflectivity model includes separate modules for the free-space propagation, terrain and sea forward scatter and terrain and sea backscatter (clutter). The terrain and sea forward scatter model deals with threat, jammer, and skin signals, while the terrain and sea backscatter model deals with the threat signals.

CONSTRUCTION:

Human Participation: Not required. Model is not interruptable.

Time Processing: Dynamic, closed form.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Time, penetrator RCS, antenna, radar waveform, ECM system, threat dynamics, penetrator dynamics, and clutter data.

OUTPUT: Twelve pages of printed output detailing the value of variables during a simulation run. The printed output includes penetrator dynamics of the aircraft, the antenna, and the terrain bounce antenna; threat dynamics; penetrator signals receive; ECM signals receive and transmit; penetrator signals transmit; threat signals; non-Doppler threat signals; penetrator and threat interaction; signal sources penetrator; and signal sources threat. A postprocessing program produces graphical output from the TEM run.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	N/A.
Peripherals:	Printer, device for plot output.
Language:	FORTRAN IV.
Documentation:	User's manual, engineering manual, programmer's manual, and volume containing classified descriptions of the ECM and threat processing techniques.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented:

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: Postprocessor producing graphical output.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWD.

Comments: N/A.

TITLE: TEMPO - Technical Military Planning Organization

MODEL TYPE: Training and education.

PROPONENT: Air Force Wargaming Center (AFWC), Maxwell AFB, AL 36112.

POINT OF CONTACT: Col. T. Yax, AUCADRE/WGO, Maxwell AFB, AL 36112, (205) 293-6618, AV 875-6618.

PURPOSE: TEMPO, a seminar exercise driver, addresses force planning and resource allocation under the constraints of time, budget, and uncertainty. It is a computerized simulation of military force planning and resource management. TEMPO models force planning by analyzing and projecting weapon cost versus utility or "bang-for-the-buck." Students decide on alternate weapon procurement, life cycle costs, long range goals, force tailoring, and response to advisory maneuvers, all under the atmosphere of risk and uncertainty.

DESCRIPTION:

Domain: Air.

Span: Strategic planning only.

Environment: Strategic.

Force Composition: Air forces.

Scope of Conflict: Conventional-strategic domain.

Mission Area: Procurement.

Level of Detail of Processes and Entities: Missiles, bombers, fighters, and anti-ballistic missiles.

CONSTRUCTION:

Human Participation: Required for decisions.

Time Processing: Dynamic, time- and event-step model. Time progresses as each side completes a cycle of specified events.

Treatment of Randomness: Stochastic, direct computation.

Sidedness: Two-sided, symmetric, reactive.

LIMITATIONS: Teams must manually exchange disks.

PLANNED IMPROVEMENTS AND MODIFICATIONS: A version to work on a local area net is under development.

INPUT: Players decide how to allocate funds for R&D or to acquire, modify, or mothball applicable weapons systems. In addition, they may employ intelligence gathering, counterintelligence, and deception.

OUTPUT: Reports describing current weapons, projected weapons, weapons in R&D, maintenance costs, R&D costs, intelligence and counterintelligence efforts, force mix, and mothballed weapons.

HARDWARE AND SOFTWARE:

Computer (OS): IBM compatible MS-DOS machine with floppy and hard disk drive storage, 640 KB RAM.

Storage: 1.0 MB for executable and 0.5 MB for disk work space.

Peripherals: Monochrome monitor (color optional) and printer.

Language: MS-Pascal and MS-ASSEMBLER.

Documentation: User and maintenance manuals available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: December 1986.

Data Base: About 8 KB in 13 data files.

CPU time per Cycle: N/A.

Data Output Analysis: TEMPO includes a monitor program to recover errors by both the system and the user. It also allows for hard copy analysis.

Frequency of Use: Used 10 times per year: 6 times by the SOS and 4 times by the PMCS.

Users: SOS and PMCS.

Comments: Managed through the review and configuration control board at the AFWC.

TITLE: TFDTAM - Tactical Force Deployment Tanker Analysis Model

MODEL TYPE: Analysis.

PROPONENT: Boeing Military Airplanes, Operations Analysis, Box 7730, M/S K80-33, Wichita, KS 67277-7730

POINT OF CONTACT: John A. December, Boeing Military Airplanes, Operations Analysis, (316) 526-2956.

PURPOSE: TFDTAM determines the tanker requirements for the deployment of a tactical fighter unit and its supporting cargo aircraft. The model will determine the best tanker types and tanker bases to be used based on user specifications.

DESCRIPTION:

Domain: Land and air.

Span: Global.

Environment: Altitude, distances, and temperatures.

Force Composition: Tactical fighter unit.

Scope of Conflict: Conventional.

Mission Area: Tactical force deployment.

Level of Detail of Processes and Entities: Entities: individual aircraft. Processes: single air refueling.

CONSTRUCTION:

Human Participation: Required to set up data files for execution.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Deterministic.

Sidedness: One-sided.

LIMITATIONS: Does not model aircraft loading, loading times, aborted air refuelings, or replacement aircraft.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Input files are required to provide the following information: deployment force specification (fighter types, fuel burn data, aircraft parameters); allocation option (type of tankers to potentially use, costs, tanker basing); and data bases (takeoff temperature list, base latitude, longitude, runway length, elevation, routes with turnpoints).

OUTPUT: Output includes a schedule for the takeoff time, flying time, arrival time, fuel burn, and fuel onload for each sortie of the deployment for tankers and receivers; total report showing the number of tankers of each type and the

fuel use and cost; and detailed event summary of the times, and distances of each flight event (takeoff, start air refueling, and end air refueling).

HARDWARE AND SOFTWARE:

Computer:	Developed to run in a network of APOLLO DN300 and DN660 terminals running a AEGIS-DOMAIN/IX (Unix-based) operating system and software release 9.5.
Storage:	About 700K for the executable model. Data bases require additional space.
Peripherals:	One printer and one terminal.
Language:	APOLLO/DOMAIN Pascal and FORTRAN APOLLO DOMAIN/IX operating system calls, and RTIRIM data base management system that makes calls to Boeing Military Airplanes' Aircraft Data Base.
Documentation:	Documentation for management, user/analysts, and programmers is available.

SECURITY CLASSIFICATION: Unclassified, but data could be classified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Aircraft Data Base is established for many aircraft.

CPU time per Cycle: A typical run for a single fighter squadron would take three hours of computer time. Longer times would be required for determining the amount of cargo to carry on cargo-carrying tankers.

Data Output Analysis: Output reports include summary output and detailed output in chart form.

Frequency of Use: Several times per year for tanker analyses.

Users: Boeing Military Airplanes, Operations Analysis, Tanker/Airlift Program Support.

Comments. N/A.

TITLE: TFMS - Joint STARS Threat Force Model System

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Vulnerability Assessment Laboratory, SLCVA-CEE, Ft. Monmouth, NJ 07703.

POINT OF CONTACT: Mr. Peter Morel, AV 995-4843 or Mr. Nick Jerschkow, AV 995-4193.

PURPOSE: TFMS was designed to evaluate Joint STARS radar and weapon data link performance in an EW environment, in support of the Joint STARS EW vulnerability analysis efforts currently underway. TFMS utilizes a CORBAN SCORES VI scenario to provide target arrays and operational background environment. TFMS is currently being revised to address ongoing changes being made to the Joint STARS FSD system.

DESCRIPTION:

Domain: Land and air.

Span: Regional (Europe, Fulda Gap) based on SCORES VI.

Environment: Models terrain as well as weather and terrain cultural features per SCORES VI.

Force Composition: BLUE and RED.

Scope of Conflict: Model only addresses EW threat to Joint STARS.

Mission Area: Typical of Joint STARS deployment; can be changed via user input files.

Level of Detail of Processes and Entities: Joint STARS radar is modeled to a functional block level. Threat ECM parameters are entered by the user via input files. Target arrays, ECM deployment, and attrition effects are modeled by SCORES VI. Radar performance is evaluated on a beamprint by beamprint basis against the various target limitations and environmental factors modeled.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time- and event-step.

Treatment of Randomness: Target array attrition based on SCORES VI. Radar and weapon data link modeled deterministically.

Sidedness: One-sided.

LIMITATIONS: SCORES VI limitations apply to target arrays environment factors.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Because of the extensive changes which have been made to the JSTARS design, the model does not accurately

reflect the current JSTAR hardware and software configuration. Radar model routines are currently being revised to reflect changes made to the Joint STARS radar. Enhancements to displays and user interface are also in progress.

INPUT: Menu-driven and input files containing parametric data. Input files may be edited by user.

OUTPUT: Process graphic displays and hard copy of results of simulation runs, e.g. targets detected vs. targets present. Postprocessor routines provide additional data reduction and analysis capability.

HARDWARE AND SOFTWARE:

Computer:	MicroVAX II GPX workstation, VMS 4.5 operating system.
Storage:	9 MB RAM, approx. 145 MB hard disk storage.
Peripherals:	VR-290 workstation (includes display, keyboard, and mouse), one printer, and one plotter are the minimum required.
Language:	VAX FORTRAN, DCL, VAX GKS.
Documentation:	N/A.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: March 1988.

Data Base: Input file preparation can be a lengthy process.

CPU time per Cycle: Typically seconds to minutes depending on input configuration.

Data Output Analysis: Postprocessor provided for data presentation and analysis, hard copies of raw data.

Frequency of Use: Used approximately several times per month by those listed below.

Users. USA LABCOM-VAL, Ft. Monmouth; BDM Corp., Columbia, MD.

Comments: Managed by USA LABCOM-VAL (SLCVA-CE).

TITLE: 3DHZD - Three-Dimensional Chemical Hazard Model

MODEL TYPE: Analysis.

PROPONENT: Atmospheric Science Laboratory, ATTN: SLCAS-AE-A, White Sands Missile Range, NM 88002-5501.

POINT OF CONTACT: Mr. David Sauter, (505) 678-2078, AV 258-2078.

PURPOSE: 3DHZD is used primarily to determine the dimensions of the vapor hazard to low flying aviators from threat chemical attacks. It is mainly an operation support tool, although it can also be used as a research and evaluation tool.

DESCRIPTION:
Domain: Land and air.

Span: Local.

Environment: Models effects of weather but not terrain.

Force Composition: N/A.

Scope of Conflict: Chemical.

Mission Area: Those involving chemical usage.

Level of Detail of Processes and Entities: Effects on individual aircraft are modeled through the input of aircraft-specific flight characteristics such as flight speed.

CONSTRUCTION:
Human Participation: Required for decisions (waited for).

Time Processing: Dynamic, time-step.

Treatment of Randomness: Basically deterministic.

Sidedness: N/A.

LIMITATIONS: No complex, terrain-influenced wind.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Include terrain-influenced winds on the transport and diffusion of the chemical vapor as well as additional surface types for liquid agent evaporation rates.

INPUT: Meteorological variables and pertinent parameters describing the chemical agent attack (e.g., number and types of rounds, agent used, location of attack).

OUTPUT: Printout of length, width, and height of the vapor hazard to aviators for up to 10 user-specified times.

HARDWARE AND SOFTWARE:

Computer: IBM PC or compatible.
Storage: 100 KB on a floppy diskette.
Peripherals: Printer (optional).
Language: Turbo Pascal.
Documentation: Technical report/users guide in review.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1987.

Data Base: Already exists or can be easily obtained.

CPU time per Cycle: Negligible; runs on a PC in minutes.

Data Output Analysis: None; results are easily understood.

Frequency of Use: Variable.

Users: Defense Nuclear Agency, Chemical School, Atmospheric Sciences Laboratory.

Comments: None.

TITLE: Timeline Analysis Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Ballistic Research Laboratory (USABRL), Aberdeen Proving Ground, MD 21005-5066.

POINT OF CONTACT: Dr. Joseph K. Wald, AV 298-6669.

PURPOSE: The engagement sequence, or timeline, of a weapon system consists of a set of functions or processes, some of which must occur sequentially while others may run simultaneously. Each of these processes may be described by a different mathematical or statistical model. In order to be effective, a weapon system may have to complete its entire timeline within a certain time limit. The Timeline Analysis Model, a research and evaluation tool, is a computer program that combines the models of the various timeline components to produce a cumulative total timeline distribution. From this distribution one can determine the probability that the weapon system will be successful in meeting its time limit requirement.

DESCRIPTION:

Domain: Nonspecific.

Span: Single system analysis.

Environment: Nonspecific.

Force Composition: One weapon system.

Scope of Conflict: Exclusively conventional.

Mission Area: Nonspecific.

Level of Detail of Processes and Entities: Individual weapon systems are modeled. Model includes individual weapon system timeline components.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Analyzes one system.

LIMITATIONS: None.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Timeline component distribution statistics.

OUTPUT: Cumulative total timeline distribution curve (graphics and table).

HARDWA?F AND SOFTWARE:

Com; : Cray 2/UNIX.

Stc: Approximately 30,000 bytes necessary at run time.

Peri. .rals: 1 graphics terminal.

Language: FORTRAN.

Documentation: BRL report: The Timeline Analysis Model.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: Model completed September 1988.

Data Base: No formal data base required.

CPU time per Cycle: Typically less than one second per Monte Carlo replication.

Data Output Analysis: No postprocessing required.

Frequency of Use: N/A.

Users: U.S. Army Ballistic Research Laboratory (USABRL), U.S. Army Materiel Systems Analysis Activity (USAMSAA).

Comments: None.

TITLE: TIS - Thermal Imaging System Program

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. William McQuay, (513) 255-2164.

PURPOSE: TIS is a research and evaluation tool that is used to predict the static detection and recognition performance of EO imaging systems that are sensitive in the 3-5 um and 8-14 um wavelength regions of the electromagnetic spectrum. TIS is designed to aid in the evaluation and design of IR systems for missions, encompassing surveillance and target acquisition systems in missile airborne, tank, and air defense applications. This program may be used to evaluate the ability of proposed devices to fulfill field requirements and to recommend future system characteristics and configurations.

DESCRIPTION:

Domain: Land and air.

Span: Local and individual.

Environment: Varied weather conditions.

Force Composition: Thermal imaging system and observer viewing targets of military interest.

Scope of Conflict: Conventional (thermal imaging system).

Mission Area: The probable performance of an IR viewing system and observer.

Level of Detail of Processes and Entities: TIS simulates the target, background, intervening atmosphere, sensor system (including observer), CMs and CCMs, and then calculates the probability of detection and recognition for the target. LOWTRAN5, which serves as a subroutine, is used to calculate transmittance through varying atmospheric conditions.

CONSTRUCTION:

Human Participation: Not required. Model is not interruptable.

Time Processing: Static.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: The simplified target background representation may not yield accurate performance prediction for targets with irregular shapes and highly variable temperatures against cluttered backgrounds.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Some preliminary analysis is needed before the data deck is prepared. The inputs to the model define target, atmosphere, optics, scanning, detector, electronics, display, stabilization, CM/CMM, and irradiance.

OUTPUT: There are two levels of detail that can be requested in the output listing: the standard (abbreviated) level, which consists of five tables, and the extended output, which contains nine additional tables. These tables include data for modulation transfer function for individual and system, minimum resolvable temperature difference, detection performance probability, and recognition performance probability.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	273,408 bytes.
Peripherals:	Printer.
Language:	FORTRAN 77.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: March 1983.

Data Base: N/A.

CPU time per Cycle: Typically 22.5 seconds.

Data Output Analysis: Manual analysis of tabular results.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: TMDC3ISIM - Tactical Missile Defense Command, Control, Communications, and Intelligence Simulation

MODEL TYPE: Analysis.

PROPONENT: Joint Tactical Missile Defense Management Office, MICOM, Redstone Arsenal, AL 35898-8010.

POINT OF CONTACT: MSG S. Chavez, (205) 895-4006, AV 742-4006 or Kenneth D. Watts, (205) 726-1062.

PURPOSE: TMDC3ISIM is designed to provide a comprehensive, comparative assessment of tactical missile defense communications architectures operating dynamically in a postulated physical and electronic warfare threat environment. It is a research and evaluation tool, through which the user can easily change individual system performance characteristics and parameters through a graphic-based menu editing scheme in order to examine comparative system effectiveness.

DESCRIPTION:

Domain: Land, air, and sea surface.

Span: Theater.

Environment: Model incorporates DMA Digitized Terrain Elevation Data and Digital Feature Analysis Data.

Force Composition: Joint and combined forces.

Scope of Conflict: Conventional, non-nuclear RED and BLUE engagements.

Mission Area: C3I operational performance in air and tactical missile defense.

Level of Detail of Processes and Entities: The level of entity is a user-constructed OPFAC, which can be configured as a platform (man, vehicle, aircraft, ship, or stationary site) with systems that are selected to be appended (sensors, weapons, jammers, communication devices, etc.). OPFAC movement is initially programmed in the input scenario. Model execution thereafter alters movement according to communicated commands, engagement reactions, and attritions.

CONSTRUCTION:

Human Participation: Not required during execution; simulation is interruptible for changes and overrides.

Time Processing: Dynamic, time-step position processing and discrete event scheduling.

Treatment of Randomness: Deterministic; values are generated as a function of expected value.

Sidedness: Two-sided, both sides reactive.

LIMITATIONS: The number of elements does effect runtime.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Friendly, mutual frequency interference; RED C2; and BLUE airbase operations.

INPUT: BLUE and RED force laydown and communications connectivity, movement, and element performance characteristics.

OUTPUT: Dynamic graphic scenario playback and all element activity for desired analysis of measures of performance and measures of effectiveness.

HARDWARE AND SOFTWARE:

Computer:	Silicon Graphics IRIS 4D.
Storage:	370 MB.
Peripherals:	Seiko color hardcopy unit, cartridge tape unit, and line printer.
Language:	"C."
Documentation:	Model description (available after December 1988) and users manual (available after December 1988).

SECURITY CLASSIFICATION: Unclassified without element performance characteristics; secret with element performance characteristics.

GENERAL DATA:

Date Implemented: 15 December 1988.

Data Base: Variable.

CPU time per Cycle: Four times scenario time for complex scenarios.

Data Output Analysis: 30 minutes.

Frequency of Use: Unknown.

Users: MICOM, Redstone Arsenal, AL; OSDC3I, Washington, DC; Strategic Defense Command, Huntsville, AL; TRADOC; US Army Signal Center, Fort Gordon, GA; US Army Air Defense Center, Fort Bliss, TX; US Air Force Europe, Ramstein AFB, GE; and

Comments: Set-up time is 30 minutes.

TITLE: Tomahawk

MODEL TYPE: Training and education (support of seminar war games).

PROPONENT: Wargaming Department, Naval War College.

POINT OF CONTACT: Micromodels Manager, (401) 841-3276, AV 948-3276.

PURPOSE: Tomahawk models Tomahawk Land Attack Missile and Tomahawk Anti-Ship Cruise Missile strikes against land and sea targets. It is designed to support battle damage assessment in conjunction with larger-scale war games.

DESCRIPTION:

Domain: Land.

Span: Local.

Environment: N/A.

Force Composition: Tomahawk missiles.

Scope of Conflict: Conventional land and sea cruise missiles.

Mission Area: Strike warfare.

Level of Detail of Processes and Entities: User defines type of target, numbers of weapons, and mode of search for each single interaction.

CONSTRUCTION:

Human Participation: Required for initial inputs only.

Time Processing: Closed form.

Treatment of Randomness: Monte Carlo determination of result.

Sidedness: One-sided.

LIMITATIONS: Only useful for specific engagement vice aggregated results.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None anticipated.

INPUT: Type and number of missiles, type of attacking platform, distance from launch point to target, target description, search mode (TASM), targeting information delay time, Tomahawk attrition probabilities, and user-defined probabilities (instead of the program default values).

OUTPUT: Time delay prior to launch, probability of hit and destruction given hit, hits, target post-impact status, and Tomahawk attrition.

HARDWARE AND SOFTWARE:
Computer: IBM-compatible PC with 512K RAM.
Storage: N/A.
Peripherals: N/A.
Language: BASIC.
Documentation: User's manual, source code.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:
Date Implemented: 1988.

Data Base: Five minutes (assuming user has previously defined desired hit and lethality probabilities, otherwise the program default values are used).

CPU time per Cycle: Five seconds.

Data Output Analysis: None.

Frequency of Use: Several times per year anticipated.

Users: Wargaming Department, Naval War College.

Comments: Tomahawk is primarily designed to provide battle results for larger-scale war games. Its hits' results may be manually input to a battle damage assessment model, e.g., SHIPDAM, for more detailed damage information.

TITLE: Total Force Manpower Tradeoff Model

MODEL TYPE: Analysis.

PROPONENT: Chief of Naval Operations (OP-12), Navy Annex, Washington, DC. 20370

POINT OF CONTACT: Mr. William Gerade, OP-12G, (202) 695-1975, AV 225-1975.

PURPOSE: The Total Force Manpower Tradeoff Model is an operation support tool (decision aid) that recommends a more cost-effective mix of military and civilian manpower.

DESCRIPTION:

Domain: Sea and shore.

Span: N/A.

Environment: N/A.

Force Composition: Navy.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Modeled at the skill and grade level. Processes involve sea and shore rotation, estimates of training and career progression needs, and determination of a cost-effective mix of military and civilian manpower within budget and policy constraints.

CONSTRUCTION:

Human Participation: Required for decisions and processes. Model waits for decision.

Time Processing: Static.

Treatment of Randomness: Career progression portion is stochastic, direct computation. All other parts are deterministic, with no randomness.

Sidedness: N/A.

LIMITATIONS: At aggregate skill and grade level.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Unknown; still in development phase.

INPUT: Manpower authorizations and requirements, sea and shore rotation patterns, loss rates, individuals rates, promotion rates, billet cost, equivalent military and civilian grades and skills, and expected endstrength.

OUTPUT: Screen displays and printouts of allocation of military and civilian manpower to resource sponsor, skill, and grade.

HARDWARE AND SOFTWARE:

Computer:	IBM compatible PC running MS-DOS.
Storage:	Estimated at 10 MB.
Peripherals:	Printer.
Language:	Pascal, FOXBASE, and GAMS (linear programming package).
Documentation:	User's and systems manuals will be developed.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented:	(Planned dates):	Officer/Civilian:	January 1990
		Enlisted/Civilian:	February 1991
		Other Manpower Types:	FY 93

Data Base: Updated in about two weeks.

CPU time per Cycle: Unknown.

Data Output Analysis: Postprocessor will aid in presentation of data.

Frequency of Use: Unknown.

Users: Will be OP-12G, 122, and 123.

Comments: N/A.

TITLE: TOTAL ROUND - Total Round STANDARD MISSILE Simulation

MODEL TYPE: Analysis.

PROPONENT: Vitro Corporation, 14000 Georgia Ave., Silver Spring, MD 20906.

POINT OF CONTACT: A. J. Ondrish, (301) 231-2007.

PURPOSE: The purpose of TOTAL ROUND is to evaluate the entire flight profile and the effectiveness of the STANDARD Missile (SM), SM-1 or SM-2, from launch to target intercept.

DESCRIPTION:

Domain: Air, above sea surface.

Span: Local region.

Environment: Air; day and night.

Force Composition: N/A.

Scope of Conflict: Conventional.

Mission Area: AAW.

Level of Detail of Processes and Entities: TOTAL ROUND is a 6-degree-of-freedom simulation of all SM-1 or SM-2 missile activities in an engagement against any type of air target. A family of submodels feeds the main model to provide a total analysis package. TOTAL ROUND simulations are Monte Carlo digital computer programs that generate time histories of all major interacting variables of a total SM weapon system. All major subsystems involved in an engagement are math-modeled, including error statistics, to represent realistic conditions. The overall output of any simulation run represents the digressions from the ideal nominal conditions. Model outputs have been checked against either available flight data or simulations of various portions of round performance as used by other Navy agents, resulting in simulations capable of yielding realistic predictions of total-round performance per threat type. The missile round is simulated as 3-dimensional, 6-degree-of-freedom, rigid body motion over a nonrotating, flat earth for most SM simulations. For SM with extended range, curvature of earth can be considered in simulation. All basic air target types, including cruise missiles, bombers, fighters, and U.S. Navy drones, can be readily represented. The target model has five degrees of freedom, and can handle maneuvers of any kind including slowing down during the turndown and dive phases of anti-ship missiles. The target definition includes bistatic radar cross section and glint.

CONSTRUCTION:

Human Participation: Not required after setup for Monte Carlo runs.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Monte Carlo source error distributions are included.

Sidedness: Two-sided (SM versus target).

LIMITATIONS: None. SM simulations that are currently operational include those for the following variants: SM-1 (MR) Block V, SM-1 (MR) Blocks VI and VI-B, SM-2 (MR) Block I, SM-1 (ER) Block V, SM-2 (ER) Block II, and SM-2 (MR) Blocks I, II, and III (TARTAR and AEGIS). In addition, the SM-2 (MR) Block III AEGIS simulation is being updated to a Block IV simulation.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Improvements are continually being made to model new versions of STANDARD MISSILE as the missile is improved to give increased capabilities.

INPUT: Missile, RF, target parameters.

OUTPUT: Monte Carlo simulation set that, at end of each run, completely describes the particular dynamic missile and target situation that occurs (at time of fuzing and warhead action). For each space point a probability of hit, and probability of placing lethal warhead fragments on target can be obtained.

HARDWARE AND SOFTWARE:

Computer:	IBM 3033, VAX 8600.
Storage:	Approximately 400K Bytes.
Peripherals:	Printer.
Language:	FORTRAN and others (CSMP, ACSL).
Documentation:	User notes (extensive).

SECURITY CLASSIFICATION: Unclassified, but data base is confidential.

GENERAL DATA:

Date Implemented: Latest upgrade 1988.

Data Base: Data base rarely needs changing for a particular block of SM.

CPU time per Cycle: Approximately five minutes for a run set.

Data Output Analysis: No postprocessor used.

Frequency of Use: Daily.

Users: Vitro uses TOTAL ROUND in support of NSWC, JHU/APL, and NAVSEA.

Comments: One or more numerous limiting factors may come into play during the simulated flight of the missile, causing either reduced capability or failure. Such factors include poor search radar data, leading to bad launcher orders; very small, fluctuating target radar return, making missile terminal homing difficult; trajectories requiring large lead angles, leading to seeker head limit failures; or high altitude flights leading to aerodynamic instability.

TITLE: TRANATAK - Transportation Network Attack

MODEL TYPE: Analysis.

PROPONENT: U.S. Army TRAC-LEE, ATTN: ATRC-LF, Ft. Lee, VA 23801-6140.

POINT OF CONTACT: Bruce Lasswell, (804) 734-1050/3449, AV 687-1050/3449.

PURPOSE: TRANATAK is an operations support tool used to furnish information on how transportation requests may be satisfied under constraints of load and unload capability, vehicle availability and capability, terminal and dock availability, network, and enemy attack.

DESCRIPTION:
Domain: Land and air.

Span: TRANATAK handles a wide range of scenarios and transportation networks. The user can select any geographic area where data is available and specify the location of transportation docks.

Environment: Multi-mode transportation network.

Force Composition: Variable.

Scope of Conflict: Variable.

Mission Area: Transportation system.

Level of Detail of Processes and Entities: Vehicles are loaded by weight and cube and travel over the given networks to users. Vehicles may be attacked when halted. All forms of transportation except pipeline may be considered.

CONSTRUCTION:
Human Participation: Not required--scheduled changes.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Either stochastic, Monte Carlo or basically deterministic as required by the user.

Sidedness: One-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Weight and cube of items to be moved, transportation network description, transportation request schedule (based on other model outputs or SCORES scenario), vehicle characteristics and locations, scenario such as location and priority of units, and attack schedule.

OUTPUT: Weight and cube of cargo delivered (also number of items by item), network and vehicle overloads, average and peak workload for each

link/terminal, dock and vehicle utilisation, vehicle production in terms of weight/distance, and attack results.

HARDWARE AND SOFTWARE:

Computer: Vax 11/780, UNISYS 1100 series.
Storage: Variable.
Peripherals: Printer and tape drive.
Language: FORTRAN IV, GASP IV, and FORTRAN 77.
Documentation: N/A.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1982.

Data Base: N/A.

CPU time per Cycle: Varies.

Data Output Analysis: Varies.

Frequency of Use: As needed.

Users: Proponent and U.S. Army Logistics Center.

Comments: TRANATAK was created using the Models of the Army Worldwide Logistics System (MAWLOGS).

TITLE: TRANSACT - Transportation and Supply Activities

MODEL TYPE: Analysis.

PROPONENT: U.S. Army TRAC-LEE, ATTN: ATRC-LF, Ft. Lee, VA 23801-6140.

POINT OF CONTACT: Mr. Bruce Lasswell, (804) 734-1050/3449, AV 687-1050/3449.

PURPOSE: TRANSACT is an operations support tool used to furnish information on how supply requests may be satisfied under constraints of load and unload capability, vehicle availability and capability, terminal and dock availability, network, and enemy attack.

DESCRIPTION:

Domain: Land and air.

Span: A wide range of scenarios and transportation networks. The user can select any geographic area where data is available and specify the location of supply bases and the movement of units over the area selected.

Environment: A multi-mode transportation network.

Force Composition: Variable.

Scope of Conflict: Variable.

Mission Area: Supply system connected by a transportation network.

Level of Detail of Processes and Entities: TRANSACT represents a multi-echelon supply system connected by a multi-mode transportation network. Modes of transportation can be prioritized when a push system is used for supply. Supply requests can be split among several suppliers. Shipments in the system are consolidated into vehicle loads, and vehicles are allocated and loaded for movement of the shipments. The movement of vehicles throughout the network is simulated over time to permit the analysis of traffic flows and overloads. The model uses the available transportation capability to move all vehicles, and chooses alternate routes if overloads or attacks reduce network capability. Vehicles may be attacked when halted and terminals, supply points, and network may be attacked. Individual shipments are off-loaded from vehicles based on the routing, priority, and vehicle capacity, and are possibly loaded onto other carriers to reach the shipment destination.

Varying demand patterns may be specified to represent changing conditions on the battlefield. The demands from units in different locations drive the model to satisfy the movement requirements over the transportation network. Initial allocation of vehicles can be made to the different units and transportation terminals to specify the capabilities available.

CONSTRUCTION:

Human Participation: Not required--scheduled changes.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Either stochastic, Monte Carlo or basically deterministic as required by the user.

Sidedness: One-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Weight and cube of items to be moved, supply support structure and stockage parameters/policy, transportation network description, supply request schedule, vehicle characteristics and locations, scenario such as location and priority of units, and attack schedule.

OUTPUT: Weight and cube of cargo delivered (also number of items by item), items requested, network and vehicle overloads, average and peak workload for each link/terminal, queue buildups for each link/terminal, supply point workloads and supply status by node/class/item, dock and vehicle utilization, BOH at supply units over time, vehicle production in terms of weight and distance, and attack results.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	Variable, depending on size of supply system and network detail.
Peripherals:	Printer and tape drive.
Language:	FORTRAN 77, FORTRAN IV, and GASP IV.
Documentation:	Users' Guide for LOGATAK II, (DLSIE 42543-MC), Programmers' Guide for LOGATAK II.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1982.

Da[illegible] Pr[illegible] N/A.

CPU time per Cycle: Variable.

Data Output Analysis: One to three weeks.

Frequency of Use: As needed.

Users: Proponent and U.S. Army Transportation School, ATTN: ATST-CDC, Ft. Eustis, VA 23604-5394.

Comments: TRANSACT was created using the Models of the Army Worldwide Logistics System (MAWLOGS) modeling system.

TITLE: TRANSMO - Transportation Model

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Concepts Analysis Agency, Strategy and Plans Directorate, 8120 Woodmont Avenue, Bethesda, MD 20814-2797.

POINT OF CONTACT: LTC Robert J. Peresich, (202) 295-0257, AV 295-0357.

PURPOSE: TRANSMO is used primarily to analyze strategic deployment issues taken in the context of the Defense Guidance Illustrative Planning Scenario. It specifically simulates the loading of cargo on intertheater lift vehicles, ultimately resulting in an arrival sequence of cargo in the theater(s) of operation.

DESCRIPTION:

Domain: Sea and air.

Span: Accommodates any theater or theaters depending on data base input.

Environment: Availabilities of intertheater lift assets and loading and unloading times are represented in terms of hundredths of an hour. Port throughput capacities are represented by numbers of lift assets that can be handled at any given time during the simulation.

Force Composition: Movement requirements represent all services, with particular emphasis on Army requirements (data base dependent).

Scope of Conflict: Generally conventional with capability to represent chemical degradation of ports.

Mission Area: Generally represents sea and airlift requirements.

Level of Detail of Processes and Entities: Processes on an hourly basis for aircraft and a daily basis for sealift. Lift assets are represented by their speed and capacity--short tons for airlift and short tons, square feet, and measurements tons for sealift. Movement requirements, which represent a varied level of detail from a division to a UIC or an aggregation of resupply or ammunition requirements, are displayed by their characteristics (bulk, over, outsize cargo for air requirements and short tons, square feet, and measurement tons for sealift requirements). Attrition is based on an expected value; if sea of air assets are in the zone of hazard during the period in which attrition is being applied, each vessel will be attrited by the expected attrition value in effect. TRANSMO can be viewed as a model with a flexible level of detail ranging from a low to a high level of resolution depending upon the input data.

CONSTRUCTION:

Human Participation: Not required; relies on scheduled changes.

Time Processing: Dynamic, time- and event-step.

Treatment of Randomness: Sea and air attrition are deterministically determined based on expected value during a time period.

Sidedness: One-sided.

LIMITATIONS: No specific limitations.

PLANNED IMPROVEMENTS AND MODIFICATIONS: **Loading algorithms are being modified to establish a priority sequence of cargo loading and subsequent movement.**

INPUT: Scenario data includes lift asset availability at POEs, time available, asset capacities, load and unload times, distances between ports, and predetermined attrition rates. Movement requirements are represented in terms of availability at the POE; latest arrival date at the POD; and characteristics of the requirement expressed in terms of short tons, square feet, and measurement tons.

OUTPUT: Depends on the level of detail and quality of the input. Produces printouts of movement requirements, attrition associated with each requirement, and arrival time at the POD. Many other analyst reports are available for review to determine how the deployment was conducted.

HARDWARE AND SOFTWARE:

Computer:	Orginally designed to run on the UNISYS 1100/84. Primarily executed on the VAX 8600 with VMS operation system.
Storage:	80,000 blocks (40 MB) for the model only.
Peripherals:	Minimum requirements: one printer, one VT100 terminal, and one 400,000-block hard disk.
Language:	FORTRAN 77.
Documentation:	Users manual with two appendices.

SECURITY CLASSIFICATION: Unclassified, but data bases are generally classified.

GENERAL DATA:

Date Implemented: 1979.

Data Base: Full scenario development and generation of movements requirements require approximately two man-months of effort.

CPU time per Cycle: Scenario dependent, but normally under 30 minutes.

Data Output Analysis: Postprocessor aids in analysis of outputs. Analysis is generally completed within three weeks after the first output is produced.

Frequency of Use: In constant use to support USACAA studies. The model is run more than 100 times per year.

Users: USACAA.

Comments: Managed by the USACAA to support all strategic deployment studies supporting larger efforts (OMNIBUS, TAA, etc.) Changes to the model are made as necessary to support model improvement or when analytical needs dictate.

TITLE: TRICIA - Theater Attrition Model

MODEL TYPE: Analysis.

PROPONENT: Air Force Center for Studies and Analyses, Directorate for Theater Force Analyses, Fighter Division (AFCSA/SAGF), The Pentagon, Room 1D380, Washington, DC 20330-5420.

POINT OF CONTACT: Maj W. G. Aten, (202) 694-4247, AV 224-4247.

PURPOSE: The TRICIA model is a research and evaluation tool used to determine relative aircraft attrition caused by RED surface-to-air threats.

DESCRIPTION:
Domain: Land and air.

Span: Accommodates any theater depending on the data base. Primarily used in the European Theater.

Environment: Models day and night operations.

Force Composition: Single- or multi-ship flight of BLUE air-to-surface aircraft (identical aircraft only) in a RED threat environment.

Scope of Conflict: Conventional warfare; air-to-surface missions.

Mission Area: Conventional fighter aircraft on air-to-surface missions (i.e., CAS, BAI, and AI).

Level of Detail of Processes and Entities: Can determine the relative attrition of different BLUE aircraft (one or more aircraft within a single flight) versus a given RED ground threat.

CONSTRUCTION:
Human Participation: Required for decisions and processes. All data input accomplished prior to each execution of the model.

Time Processing: Dynamic, no time or event steps.

Treatment of Randomness: Deterministic (no randomness).

Sidedness: One-sided.

LIMITATIONS: Does not model force packaging.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Threat laydown (within generic cells vs specific geographic coordinates), very specific threat capability descriptions and single-shot PKs, and aircraft characteristics (RCS, IR signature, optical cross-section, maneuverability, threat awareness, ECM capability, etc).

OUTPUT: Computer printouts with attrition, detection, shop, and individual threat summaries.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on any FORTRAN-capable machine.
Storage:	200-250K for each data input set; 3-50K for each output file.
Peripherals:	Terminal and printer.
Language:	FORTRAN.
Documentation:	None.

SECURITY CLASSIFICATION: Source code is unclassified, but the required threat data base is secret/noforn/no contractor.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Several man-days to several man-weeks, depending on size of effort. Requires output from other models such as ESAMS and P001.

CPU time per Cycle: 10-15 seconds.

Data Output Analysis: None.

Frequency of Use: Varies with user. Several times per month within SAGF.

Users: AFCSA/SAGF, TAC/XP-JSG.

Comments: TRICIA is an in-house model and is not available for distribution.

TITLE: TSAR - Theater Simulation of Airbase Resources

MODEL TYPE: Analysis.

PROPONENT: The Rand Corporation.

POINT OF CONTACT: Mr. Robert Hume or Mrs. Diane Jimenez, (904) 882-9113/4, AV 872-9113/4.

PURPOSE: TSAR analyzes interrelations among the resources associated with a set of airbases. With input from TSARINA, TSAR further analyzes the airbases' capability to generate aircraft sorties in a wartime environment. TSAR can be used as either a research and evaluation tool or an operations support tool. It can determine weapon systems effectiveness and all aspects of force capability and as well as develop new or revised doctrine.

DESCRIPTION:

Domain: Land and air.

Span: Accommodates any theater depending on data base.

Environment: Simulates time of day over a designated sequence of days; meteorological conditions; day and night operations; availability and repair status of TOLS, buildings, and 11 classes of resources; and geography (location and size of TOLS and facilities).

Force Composition: Simulates RED air and ground attacks on BLUE base resources, facilities, and aircraft (or reverse scenario). Can model cross-trained personnel and reserve support.

Scope of Conflict: Conventional and chemical weapons attacks simulated when TSARINA input used. Conventional weapons loading on sorties generated from modeled base(s) simulated.

Mission Area: Simulates any type aircraft mission via weapons statistics on weapons loading, probabilities of kill and damage, and flight resources.

Level of Detail of Processes and Entities: Can model resources and tasks for 1 to 63 airbases that can be subdivided into squadrons of aircraft and shops. Asset accounting completed for each type of resource, by base, within 11 classes of resources. Aircraft, air crews, fuel trucks, facilities, and repairable spare parts monitored individually; all others handled in more aggregate terms.

CONSTRUCTION:

Human Participation: Not permitted. Updates to data deck completed easily.

Time Processing: Dynamic, time- and event-step.

Treatment of Randomness: Monte Carlo, discrete-event. Random number generator can reproduce seed values for trials used in all model computer runs or select seed values randomly.

Sidedness: Two-sided, asymmetric, one side nonreactive, reversible.

LIMITATIONS: Does not consider results of damage or demolition of utilities except electrical or base communication systems.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Expected Version 4 improvements will affect input and output procedures and capabilities, parts and equipment repair, pre- and post-flight procedures, sortie supply and demand logic, chemical ensembles at different bases, aircraft attrition and transfer directives, and dispersed operating bases.

INPUT: TSAR data base: primary control data, task criticality and aircraft status, resource requirements, initial stocks of resources, intratheater and CONUS shipment schedule, airbase facility and attack tables, initialization of aircraft and shop status, chemical warfare effects, and sortie demand data.

OUTPUT: In-depth statistics and information specified via TSAR input control data. Summary reports and plots can be produced indicating sortie generations from one or more scenarios and target impacts on TOLS and facilities.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on an IBM (370/3032), but is compatible with a VAX computer with a VMS operating system or any 32-bit-word machine with enough storage.
Storage:	Approximately 3 MB required. An additional 400 to 1600 KB is required for data base storage.
Peripherals:	Terminal; printer and plotter for summary reports.
Language:	FORTRAN 77.
Documentation:	Three user's guides published by the Rand Corporation: Program Features, Logic, and Interactions, Data Input, Program Operations and Redimensioning, and Sample Problem, and Variable and Array Definitions and Other Program Aids.

SECURITY CLASSIFICATION: Unclassified, but data bases can be classified.

GENERAL DATA:

Date Implemented: 1980.

Data Base: Gathering valid data can be time consuming. Modifying data is accomplished by editing input file with appropriate values.

CPU time per Cycle: Depends on scenario and control option. Can range from several minutes to half an hour.

Data Output Analysis: Output from TSAR can be massive, but is relatively easy to understand and operationally valuable. Utility programs and plots can pull specific sortie and base damage information from output.

Frequency of Use: Used as often as daily by organizations listed below.

Users: Air Base Operability, Logistics and Plans and Programs.

Comments: Awaiting release of new version by the Rand Corporation.

TITLE: TSARINA - Theater Simulation of Airbase Resources (TSAR) INputs using Airbase Damage Assessment model

MODEL TYPE: Analytic input to TSAR.

PROPONENT: The Rand Corporation.

POINT OF CONTACT: Mr. Bob Hume or Mrs. Diane Jimenez, (904) 552-9113/4, AV 872-9113/4.

PURPOSE: TSARINA may be used as a general-purpose, complex-target damage assessment model, although its intended primary role is to support the TSAR aircraft sortie generation simulation program. When used with TSAR, TSARINA can assess multiple trials of a multibase airbase attack campaign. The impact of those conventional and/or chemical attacks on sortie generation can be derived using the TSAR model. TSARINA can be used as either a research and development tool or an operations support tool. TSARINA output depicts how weapons damage the simulated bases' resources, aircraft, and facilities after one or a series of attacks.

DESCRIPTION:

Domain: Although this model considers processes both on land and in the air, generated results pertain to occurrences on land.

Span: Accommodates simulation of an individual base, a set of independent bases, or a set of interdependent bases. Data bases developed include specific Central European and United Kingdom bases as well as generic Central European, United Kingdom, SW Asian, and PACAF regions.

Environment: Simulates activities over a day or series of days; meteorological conditions to include temperature, wind velocity and direction, and atmospheric stability; and geography consisting of location and size of take-off and landing surfaces (TOLS) and facilities.

Force Composition: Simulates effects of RED attacks on BLUE airbase resources, aircraft, and TOLS. Scenario can be reversed.

Scope of Conflict: Attacks to base(s) can be conventional or chemical.

Mission Area: Simulates effects of hostile attacks to base(s).

Level of Detail of Processes and Entities: TSARINA models individual entities as resources of a specified airbase. Different mean areas of effectiveness or kill probabilities can be defined for different resources, and a two-level "cookie cutter" can be used to represent the effectiveness of weapons against the seven classes of resources. Delivery parameters help determine the arrival location of the weapons while Monte Carlo procedures determine which weapons arrive at the target.

CONSTRUCTION:

Human Participation: Not permitted. Updates to data base completed easily.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, symmetric, reversible.

LIMITATIONS: Does not currently consider damage to utilities, except electrical, or to base communication systems.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Subsequent attacks on MOS; aircraft shelter damage and increased vulnerability for impacts in front of shelter doors; simulation of unexploded ordinance detonations.

INPUT: The TSARINA data base consists of control data, target data, MOS data, attack scenario, resource designators, chemical effects and monitoring point data, and weapons delivery and effectiveness parameters.

OUTPUT: Statistical results: targets hit, average losses of resources at each target, average of the initial surface deposition of chemical agents, and a summary of runway closures and required repairs to meet MOS requirements.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on 32-bit-word machines.
Storage:	Requires approximately 127 KB for the executable program and 200 KB for the data base. Output for TSAR requires approximately 1 MB.
Peripherals:	Terminal connected into computer system; printer and plotter for summary reports.
Language:	FORTRAN 77.
Documentation:	User's guide published by the Rand Corporation, TSARINA--A Computer Model for Assessing Conventional and Chemical Attacks on Airbases.

SECURITY CLASSIFICATION: Unclassified, but data bases can be classified.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Modifying data is accomplished by editing the data file with appropriate values. Gathering valid data can be time consuming.

CPU time per Cycle: Changes with options selected. Increases with large number of trials and chemical attack processing. Run can take from a few minutes to a half hour.

Data Output Analysis: Summary output lists easily readable input data and hit summary by trial. Optional output plots location of craters and MOS.

Frequency of Use: Used when testing a new base or region. Once established, can be used, usually without modification, to test operational procedures or equipment modifications with TSAR.

Users: Air Base Operability, Logistics, and Plan and Programs.

Comments: Awaiting release of version four by the Rand Corporation.

TITLE: TTSM - Theater Transition and Sustainment Model

MODEL TYPE: Training and education (under development).

PROPONENT: HQ USEUCOM and HQ USAREUR.

POINT OF CONTACT: MAJ Joe Manzo, AV 430-5354.

PURPOSE: TTSM will function as a command post exercise driver. It will model wartime support activities that occur during the transition to war and during combat in theater rear-area operations.

DESCRIPTION:

Domain: Primarily theater, rear-area.

Span: Initially European theater-level, but design will allow it to be adapted to other theaters.

Environment: A node and link network representation.

Force Composition: Joint and combined forces and host nation civilian support agencies.

Scope of Conflict: Rear-area conflict will be determined by the combat model used as the combat driver.

Mission Area: Theater, rear-area.

Level of Detail of Processes and Entities: Variable depending on the mission-area modules to be played. The design permits the level of resolution to be set in conjunction with the objective of the exercise to be supported. All functional modules have not been selected at this time. Candidate modules include intratheater transportation, logistics, personnel, medical, engineer, communications intelligence, and rear-area combat operations.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Basically deterministic in that it determines values from data base information. Randomness applications have not been determined.

Sidedness: The TTSM mission-area modules will be one-sided in their stand-alone mode. However, when TTSM modules are used in conjunction with an exercise involving the interaction with a combat model, the modules can be considered asymmetric. TTSM will not affect RED logistics play but will impact indirectly on the RED combat operations through the combat model.

LIMITATIONS: TTSM modules will only simulate theater, rear-area functions. It is not a combat resolution model.

PLANNED IMPROVEMENTS AND MODIFICATIONS: The model is at the prototype development phase. POC will be incremental with fielding of each module as they are developed. The prototype demonstration is scheduled for September 1989.

INPUT: Relational data bases (RDBs) must be developed for each mission-area module. INGRES is the standard RDB system being used for development.

OUTPUT: Computer printouts and CRT reports of event occurrences as well as preformatted standard reports and ad hoc queries.

HARDWARE AND SOFTWARE:

Computer: Designed so that each mission area module will operate on a separate VAX computer with a VAX/VMS operating system. The configuration planned includes a central computer with a resident executive program acting as the interface between the combat model (operating on a separate system) and the mission-area modules.

Storage: Depends on size of module data bases.

Peripherals: Minimum requirements: one printer and five VT220 terminals per mission area module involved in a given exercise.

Language: Both "C" and Ada are being considered for the production model.

Documentation: The final documentation requirements have not been determined. Current plans call for users manuals, scenario development guides, and a data requirements guide.

SECURITY CLASSIFICATION: Unclassified, but data bases may be classified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: N/A.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: N/A.

Users: N/A.

Comments: The model is being designed to operate on a distributed system. Each mission area module will operate on a separate MICRO VAX general family type of computer.

TITLE: TW/AA End-to-End Model

MODEL TYPE: Analysis (can also be used for training).

PROPONENT: AFSPACECOM/XPW, Peterson AFB, Colorado Springs, CO.

POINT OF CONTACT: Bill Teague, Teledyne Brown Engineering, (719) 574-7270.

PURPOSE: As a research and evaluation tool, the TW/AA model is used to analyze the response of the current TW/AA system to user-defined scenarios. It can also be used to estimate the effects of future system upgrades. As an operating tool, the model can support real-time test exercises by a prior determination of the expected response. In addition, the model can be used for training and education by emulating the five common command center displays or by driving the actual missile warning hardware and software of the NCS.

DESCRIPTION:

Domain: Missile warning (land, space, and sea).

Span: Global threat (currently USSR).

Environment: Spherical Earth, benign or stressed environment (nuclear jammers).

Force Composition: Currently RED (USSR) ICBM and SLBM data base.

Scope of Conflict: Nuclear weapons.

Mission Area: Tactical warning and attack assessment, missile warning mission.

Level of Detail of Processes and Entities: Radar (beam scheduling, signal processing surrogates, and message generation), space-based sensors (focal plane processing and message generation), communications (message length and content; protocols, buffers, network media and topology; and message routing-stress effects), and command centers (message processing by type and five command displays).

CONSTRUCTION:

Human Participation: Not permitted, except for run setup and operation of command center displays.

Time Processing: Dynamic, event-step.

Treatment of Randomness: Stochastic, direct computation.

Sidedness: Two-sided, asymetric, one side nonreactive.

LIMITATIONS: 1000 boosters.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Update to early 1990s TW/AA configuration.

INPUT: Threat scenario, TW/AA configuration.

OUTPUT: Computer printouts, plots, and display hardcopy.

HARDWARE AND SOFTWARE:

Computer:	VAX/VMS.
Storage:	Data bases/executables: 15 MB; Simulation execution files: 25 MB (100 boosters).
Peripherals:	Line printer and Megatek or Tektronix graphics terminals.
Language:	FORTRAN 77.
Documentation:	Complete user and maintenance documentation.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: 1986.

Data Base: Several man-months if generated from scratch.

CPU time per Cycle: Up to 24 hours for 1000 boosters, 40,000 objects.

Data Output Analysis: Several days.

Frequency of Use: Unknown.

Users: AFSPACECOM, USASDC, The Joint Staff/J-8.

Comments: Models TW/AA system as of 1986; composed of separate computer programs that run in sequence; missile warning mission of TW/AA.

TITLE: TWSEAS-IMC - Tactical Warfare Simulation, Evaluation and Analysis System - Integrated Maneuver Controller

MODEL TYPE: Training and education.

PROPONENT: Marine Corps Wargaming and Assessment Center (WG06), MCCDC, Quantico, Virginia 22134-5001.

POINT OF CONTACT: CAPT T. J. Reeves, (703) 640-3276, AV 278-3276.

PURPOSE: TWSEAS-IMC is a computer-assisted, command and control, war game-based training system designed to support Marine Corps war games, troop landing and field maneuvering exercises, and staff-oriented training games. Through battle simulation, TWSEAS-IMC provides a realistic, real-time environment that will allow the commander and staff to practice staff functioning and decision making. In addition, it provides the Tactical Exercise Control Group with a vehicle that manages and controls all levels of command post exercises in a cost-effective manner.

DESCRIPTION:

Domain: Land, sea, and air.

Span: TWSEAS will support individual, local, or regional data bases.

Environment: Square-based. 1200 km on a side. Positioned within that square is a 100 km square containing a digital terrain data base. Eight filler zones are used to complete the 100 km square if the digital terrain does not fill up the entire 100 km. The remainder of the 1100 km x 1100 km forms an 11 x 100 km square tabletop. Each tabletop square can be individually designated at various vegetation and trafficability values. Factors such as time of day, weather, and barriers are utilized to influence the speed of unit movement.

Force Composition: One exercise staff playing the landing force and the controller playing the opposing force, or an exercise, or an exercise staff for each side. CPXs can range from low level, company or platoon, to high level, MEB or MEF.

Scope of Conflict: Conventional weapons.

Mission Area: All conventional missions except unconventional warfare.

Level of Detail of Processes and Entities: An addressable unit is considered to be either a ground unit or a surface fire support ship. There are 600 addressable units allowed in the exercise. A ship is represented as a circle with the center point as the current location. It is subject to casualty damage assessment. The representation is more complex for ground units. A ground unit can be configured with a wide array of formations and various sizes. Several missions ranging from highly offensive to highly defensive, may be assigned to any unit. These missions, from most offensive most timid, are seize, move, recon, defend, and withdraw.

Rotary and fixed-wing aircraft are addressable in terms of having commands to modify their original mission and to obtain information about them.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time-driven model. Ratio can be changed from real time to allow many days of gaming to occur in a single day.

Treatment of Randomness: Probability of hit and kill are determined stochastically. Outcomes are nondeterministic.

Sidedness: Two-sided, symmetric, reactive model.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Integrated maneuver controller under development.

INPUT: Combat orders, as transmitted by the player staffs, are reduced to prescribed message formats for acceptance by the computer and entered through terminals.

OUTPUT: Event-oriented solicited and unsolicited reports are generated in the form of messages at the appropriate terminals and reinforced at graphic displays.

HARDWARE AND SOFTWARE:

Computer:	AN/UYK-7.
Storage:	229,376 words of memory.
Peripherals:	2 CPUs and 16 channels.
Language:	CMS-2.
Documentation:	Employment manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1977 for TWSEAS. IMC is still under development.

Data Base: A week to prepare large data bases.

CPU time per Cycle: Dependent on data base size and player configuration.

Data Output Analysis: Manual analysis conducted by TACEX staff.

Frequency of Use: Varies by each user based on training requirements and availability. Total use of the system is generally monthly.

Users: Fleet Marine Force and formal schools at MCCDC.

Comments: None.

TITLE: URBAT - Urban Battle Trainer

MODEL TYPE: Training and education.

PROPONENT: Prototype being developed by: Systems Assessment Group, Royal Military College of Science, Shrivenham, Swindon, Wiltshire, SN6 8LA, U.K.

On behalf of: Commander Training and Arms Directors, Headquarters, United Kingdom Land Force Wilton, Salisbury, Wiltshire, SP2 0AG, U.K.

POINT OF CONTACT: (RMCS) J. R. Searle, Project Manager, 0793-785309 and (HQ UKLF) Lt. Col M. W. Ward, G3(Trg), 0722-336222 X 2690.

PURPOSE: The Army is developing URBAT to be part of a unit All Arms training package for use at a new FIBUA training complex. To complement other forms of training, URBAT will illustrate aspects of the battle that they cannot represent. It is to be used as a seminar exercise driver for groups of up to 10-15 commanders.

DESCRIPTION:

Domain: Land battle.

Span: Only one Army training area village now, but to be extended to four.

Environment: Represents an urban area up to a total size of approximately 600m x 400m, in terms of 2m square cells. Terrain features modeled at this level include ground height, roads, buildings and woods. The final version is intended to also represent up to 2Km of surrounding terrain at a lesser level of resolution. Currently only daytime operations modeled.

Force Composition: Attacking All Arms forces up to battle group and defending All Arms forces up to company group.

Scope of Conflict: Conventional warfare.

Mission Area: The principles and various phases of All Arms attack and defense of an urban area.

Level of Detail of Processes and Entities: Dismounted infantry represented in section (eight men) or fire-team (four men) strength. Detachments from these units can be individual men. Individual vehicles are considered. Individual classes of weapon systems are modeled for all entities. Instructions for action may be given to each any entity, as if by its local battlefield commander. Line of sight, detection, direct fire, movement, indirect fire, and house clearance in varying degrees of sophistication modeled.

CONSTRUCTION:

Human Participation: Required for most decisions (except some low-level decisions to open fire). The style of game may be varied to either pause and prompt for action decisions or to continue processing. Currently, some controller moderation of the processes is also required (e.g., to maintain the overall structure of the battle and the games training objectives).

Time Processing: Dynamic, using an event-based scheduling assessment and reaction system at second-by-second resolution, within a one minute time slice for player major decision-making (the latter time can by the user).

Treatment of Randomness: Stochastic with Monte Carlo methods, probability distributions, etc.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Currently a prototype, the model is deliberately limited in its portrayal of the urban battle. Investigation is intended to determine whether a practical training aid of this form can be developed at all.

PLANNED IMPROVEMENTS AND MODIFICATIONS: A fully developed URBAT, based on the prototype, is due to go into service in early 1990. Aspects likely to change include use of real (rather than dummy) data, the introduction of communications modeling, reduction in the need for manual controller moderation, increases in direct and indirect fire weapons classes, incorporation of surrounding terrain, modeling of obscuration and review and redesign of game input and output facilities and methods.

INPUT: Force structure, weapons and ammunition mixes, and starting positions.

OUTPUT: Simple textual display and printout of summary information relating to the within-round actions and end-of-round summary status of all entities.

HARDWARE AND SOFTWARE:

Computer:	20 Mhz 80386 IBM PC compatible, under PC-DOS, with 2 MB RAM.
Storage:	Hard disk. Minimum 20 MB to allow for battle history files.
Peripherals:	2 x LINUS Write-Top IBM PC compatible portable computers as controller input and output workstations.
Language:	Pascal, MODULA-2, "C," and BASIC.
Documentation:	None yet.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1989/1990.

Data Base: Not yet known.

CPU time per Cycle: Depends on size of battle and degree of interaction. Early prototypes operating without interaction and with a company-versus-platoon battle required approximately 15 seconds real time to assess 60 seconds of battle.

Data Output Analysis: None yet.

Frequency of Use: None yet, but final version is likely to be used weekly.

Users: FIBUA Training Complexes.

Comments: None.

TITLE: UVWR - Ultraviolet Warning Receiver Detection Range Program

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. William McQuay, (513) 255-2164.

PURPOSE: UVWR is a research and development tool designed to calculate the detection range of an aircraft-based warning receiver operating in the UV spectral region. This detection range is calculated for a particular meterological environment.

DESCRIPTION:
Domain: Air.

Span: Local and individual.

Environment: Varied weather options.

Force Composition: Single aircraft-based UVWR.

Scope of Conflict: Conventional (UV sensor).

Mission Area: UV warning receiver detection ranges.

Level of Detail of Processes and Entities: The user selects program control options that allow user input or computer calculations of the source spectral radiant intensity and solar background count rate. The atmospheric transmittance calculations are performed using LOWTRAN5, which serves as a subroutine. The detection range equation is solved using subroutines from the LOCNES program.

CONSTRUCTION:
Human Participation: Not required. Model is not interruptable.

Time Processing: Static.

Treatment of Randomness: Basically deterministic.

Sidedness: One-sided.

LIMITATIONS: Cloud layers above the warning receiver are not included; the diffuse solar background radiation is assumed to be independent of altitude.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: System parameters such as detector area, quantum efficiency, file characteristics. The UV solar background count can be input by the user or calculated by the model. The UV radiation from the target source may be characterized as a blackbody or by input values of the spectral radiant intensity. Meteorological condition options are also set by the user. In addition, the user must specify the sea level visual range (visibility) and

may specify the total ozone concentration, the surface reflectivity, and the height of the reflecting surface above ground level.

OUTPUT: UVWR detection ranges versus the solar zenith angle. The total ozone concentration is also printed if the LOWTRAN5 model value is used.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780.
Storage:	189,952 bytes.
Peripherals:	Printer.
Language:	FORTRAN 77.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: March 1982.

Data Base: N/A.

CPU time per Cycle: Typically 12.3 seconds.

Data Output Analysis: Manual analysis of tabular results.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: VAST - Vulnerability Analysis for Surface Targets

MODEL TYPE: Analysis.

PROPONENT: Ballistic Research Laboratory, Aberdeen Proving Ground, MD 21005-5066.

POINT OF CONTACT: L. D. Losie, (301) 272-6979, AV 298-6979.

PURPOSE: VAST is a component-level point burst methodology that is used to estimate the vulnerability of a surface target to a hit either by a shaped charge jet or by fragmentation from artillery. VAST is an expected value model that infers the vulnerability of a target from the cumulative effects of calculated component damage, which degrades the tactical functions of such an inflicted ground armored vehicle.

DESCRIPTION:

Domain: Abstract.

Span: N/A.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: N/A.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: N/A.

Treatment of Randomness: N/A.

Sidedness: N/A.

LIMITATIONS: VAST models damage mechanisms of penetration and spall, but does not model the effect of other damage mechanisms, such as ricochet, secondary spall formation or hydraulic ram, on components.

PLANNED IMPROVEMENTS AND MODIFICATIONS: No improvements or modifications are currently planned.

INPUT: VAST requires a variety of input data that includes a table defining each component of the surface target, a table of component conditional probabilities of kill, data describing an attacking munition, a rule book for converting component loss into tactical degradations of vehicular functions, and files containing geometric information on the armored vehicle.

OUTPUT: For fragments from an artillery shell, VAST produces tables of vulnerable areas for individual components and for the target. For a shaped charge jet, VAST produces target probability of kill estimates.

HARDWARE AND SOFTWARE:

Computer:	Currently runs on a CRAY XM-P under a UNICOS operating system.
Storage:	VAST requires 300K words of memory for program execution. Memory requirement for a typical geometry file is 5000K words.
Peripherals:	One VT100 terminal or similar equipment and one printer.
Language:	FORTRAN.
Documentation:	Two contractor reports and one government report.

SECURITY CLASSIFICATION: The code is unclassified, but some of the inputs could be classified.

GENERAL DATA:

Date Implemented: 1978.

Data Base: No data base per se, but preparing inputs can take as long as one year.

CPU time per Cycle: Execution time depends upon the combination of surface target and attacking threat. A detailed analysis may require one hour of CPU time.

Data Output Analysis: Postprocessor aids in output analysis.

Frequency of Use: VAST is used several times per year.

Users: Ballistic Research Laboratory.

Comments: None.

TITLE: VECTOR-3

MODEL TYPE: Analysis.

PROPONENT: Vector Research, Incorporated (VRI), P.O. Box 1506, Ann Arbor, Michigan 48106.

POINT OF CONTACT: Alan Weintraub, (313) 973-9210.

PURPOSE: VECTOR-3 is a research and evaluation tool which deals with force capability and requirements (i.e., R&D planning, systems acquisition, and force structure issues), as well as combat development (doctrinal issues).

DESCRIPTION:

Domain: Land and air.

Span: Can vary from division to theater.

Environment: Terrain cells (typical size 4 x 7 km.) distinguish differences in battlefield trafficability and intervisibilty. Natural and man-made barriers can be played. A transportation network is also represented. Weather conditions, which are uniform throughout the battlefield and are updated each hour, can affect both trafficability and visibility for air and ground operations.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional warfare.

Mission Area: All conventional AirLand mission areas.

Level of Detail of Processes and Entities: Unit resolution is user specified (e.g., battalion maneuver unit resolution for a corps-level scenario). In tactical air operations, resolution is to user-specified individual flight group (typically two to four aircraft). For air transport operations, the group size is one aircraft, i.e., each sortie is individually simulated. In most process modeling, the level of system resolution is the individual system type in the unit.

CONSTRUCTION:

Human Participation: Not required. Scheduled changes are allowed.

Time Processing: Dynamic, time-step and event-step model. Eight nested clocks are used to reduce execution time while allowing statuses to be updated at appropriate frequencies.

Treatment of Randomness: Deterministic, generates a value as a function of an expected value.

Sidedness: Two-sided, symmetric.

LIMITATIONS: No naval, chemical, biological, or nuclear warfare.

PLANNED IMPROVEMENTS AND MODIFICATIONS: No specific improvements are currently planned, but the model is regularly modified to add capabilities required to support new applications.

INPUT: System performance capabilities, initial force and supply inventory and organizational data and a schedule of unit and resource arrivals, data describing the environment, tactical decision rules, and initial intelligence information.

OUTPUT: The total trajectory of all important statuses (missions and activities, force inventories and attrition, unit locations and movement, supply deliveries and consumption, etc.) during a campaign are stored by the model for later summary and display by postprocessors.

HARDWARE AND SOFTWARE:

Computer:	Most applications have been conducted on an IBM 3090-400 mainframe computer using the Michigan Terminal System operating system. The model also is run on Concurrent minicomputer.
Storage:	Approximately 2.6 MB.
Peripherals:	No special peripherals are required.
Language:	Transportable FORTRAN.
Documentation:	Only summary documentation and on-line program documentation exist.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1982.

Data Base: Data modifications to an existing scenario for a new study typically require on to a few person-months of effort depending on the extent of the changes. Development of an entirely new scenario can require up to a person-year.

CPU Time per Cycle: Typical execution time on the mainframe computer is approximately 1.5 CPU minutes per simulated day of corps-level combat including postprocessing of results.

Data Output Analysis: Approximately one person-week of effort is required for a thorough analysis of the results of a several-day, corps-level run.

Frequency of Use: Several studies per year.

Users: VRI has used VECTOR-3 for the U.S. Army (DCSOPS, TRADOC, AMC) and for defense industry.

Comments: VECTOR-3 is one of the latest in the VECTOR series of models. An earlier version, VECTOR-2, has been used by various Army agencies within TRADOC and AMC as well as by the SHAPE Technical Centre and several defense industrial contractors. The Army's corps-level model VIC is based in part on VECTOR-2 and thus has many similarities to VECTOR-3.

TITLE: VEDER - Visual/Electro-Optical Detection Range Model

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. Bill McQuay, (513) 255-2164.

PURPOSE: VEDER determines the visual detection ranges of specific visual/EO sensors attempting to acquire targets such as aircraft or cruise missiles. In addition, it determines a set of scaling law parameters by minimizing the difference between the detection range calculated using a scaling law and the detection range determined by the VISUAL SEARCH model.

DESCRIPTION:

Domain: Air.

Span: Local.

Environment: Models targets with a known inherent contrast flying at a given altitude and speed in a particular meteorological environment.

Force Composition: One or more observers; single penetrator target.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Entities consist of a single target and one or more observers. Observers can be characterized as either moving or stationary and on the ground or in the air. The target moves in a straight, level flight path with the visual/EO detection ranges calculated at different aspect angles relative to the target aircraft.

CONSTRUCTION:

Human Participation: Interactive selection of scenario parameters.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Visual/EO detection ranges are deterministically calculated as a function of aircraft azimuthal angles.

Sidedness: One-sided.

LIMITATIONS: Target (penetrator) flight path is straight, level, and at a constant speed. Sky background is assumed to be uniform.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Geometric areas describing the target; the target's altitude, flight speed, and inherent contrast; characteristics of the visual search field and the optics; and the surface level visibility.

OUTPUT: Summary of input data followed by the horizontal visual/EO detection ranges displayed at various azimuthal angles relative to the target, scaling law parameters, and relative errors in the scaling law.

HARDWARE AND SOFTWARE:

Computer: VAX 11/780 operating under VMS.
Storage: 247 blocks.
Peripherals: One VTxxx terminal, one printer.
Language: FORTRAN 77.
Documentation: User's manual.

SECURITY CLASSIFICATION: Source code is unclassified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: N/A.

CPU time per Cycle: 131 CPU seconds (VAX 11/780).

Data Output Analysis: No postprocessor.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: VEHW - Vehicle Weathering Model

MODEL TYPE: Analysis.

PROPONENT: CRDEC, Studies & Analysis Office, Aberdeen Proving Ground, MD 21010-5423.

POINT OF CONTACT: Mr. Richard zum Brunnen, (301) 671-3570, AV 584-3570.

PURPOSE: VEHW is used to predict liquid agent persistence and vapor emission of chemical agent droplets on a moving vehicle. It is designed to estimate liquid contamination levels on the various surfaces of a vehicle as a function of wind flow patterns, temperature, and time.

DESCRIPTION:
Domain: Land.

Span: Vehicle contamination within a targeted area or sector.

Environment: Flat, open terrain with steady-state meteorology.

Force Composition: BLUE or RED vehicles.

Scope of Conflict: Chemical warfare.

Mission Area: Chemical combat missions.

Level of Detail of Processes and Entities: The model uses the CRC methodology to consider evaporative and absorptive properties.

CONSTRUCTION:
Human Participation: Not permitted after inputs have been set up and program executes.

Time Processing: Agent weathering determined by the amount of vehicle surface contamination levels remaining as a function of time.

Treatment of Randomness: Deterministic.

Sidedness: Not applicable, because VEHW is an equipment evaluation model, not a war game.

LIMITATIONS: Methodology considers a moving vehicle with agent being picked up from contaminated terrain. It does not consider cracks, crevices, dirty vehicle surfaces, or solar loading effects, but considers only painted surfaces with steady-state meteorology. Model has not been validated.

PLANNED IMPROVEMENTS AND MODIFICATIONS: No plans for further improvements and testing exist.

INPUT: Input requirements are the following: vehicle size and geometry, ground contamination levels, droplet sizes, windspeed and angle, vehicle speed and location, distribution of vehicle temperatures, surface type, and desorption rate versus time data.

OUTPUT: Amount of agent desorbed and absorbed, amount of agent remaining as a function of time, and evaporative and desorptive flux from various vehicle surfaces.

HARDWARE AND SOFTWARE:

Computer:	Runs on the UNIVAC 1100/60 computer system.
Storage:	Approximately 2500 lines of code.
Peripherals:	Minimum requirement: one printer.
Language:	ASCII Standard FORTRAN 77.
Documentation:	Published report available.

SECURITY CLASSIFICATION: Unclassified program.

GENERAL DATA:

Date Implemented: 1984.

Data Base: Time for preparation of the data base of input values basically depends on the availability of vehicle information. Once the vehicle characteristics are available, it takes very little time (less than 15 minutes) to input the values and run the program.

CPU time per Cycle: Less than one minute.

Data Output Analysis: Postprocessing is not necessary for analysis of the output results.

Frequency of Use: Several times per year.

Users: CRDEC and contractors.

Comments: CRDEC is responsible for configuration control of model and consistency of output results.

TITLE: VGCUFS - Vehicle Gap Crossing Under Fire Simulation

MODEL TYPE: Analysis (weapon and vehicle performance simulation).

PROPONENT: U.S Army Materiel Systems Analysis Activity (USAMSAA), Aberdeen Proving Ground, MD 21005-5071.

POINT OF CONTACT: Mr. L. Martin, (301) 278-6437, AV 298-6437.

PURPOSE: VGCUFS can assess the effect of a vehicle's automotive performance or changes in vehicle parameters such as engine performance or weight on its ability to survive on the battlefield. The effect of specific terrain on the target vehicle-weapon encounter can also be examined.

DESCRIPTION:
Domain: Land.

Span: Local. Generally, participants are separated by 10,000 meters or less and separation may close depending on the path traveled by the target.

Environment: Target vehicle travels cross country over dry terrain. Threat weapon is stationary. Intervisibility varies depending on terrain being simulated.

Force Composition: One-on-one simulation: a target vehicle and a threat weapon.

Scope of Conflict: Conventional weapons, primarily direct-fire, vehicle-mounted systems.

Mission Area: Encounters between surface vehicles.

Level of Detail of Processes and Entities: Vehicle automotive performance is modeled in detail. Changes in engine power output, transmission, differential, tires or tracks, or vehicle weight may affect model output since they affect vehicle acceleration. Vehicle acceleration speed and distance traveled are computed every 0.1 seconds and are functions of vehicle power, weight, surface interface and terrain surface type, strength, and slope. The target profile presented to the weapon is a two-rectangle fit. The threat weapon is simulated using accepted methodology fed by horizontal and vertical bias and dispersion data as a function of range to target, speed of target, and angle approach of target. Terrain is defined by soil type and strength, surface slope, and "in view" and "out view" segment lengths. These segment lengths are developed by making random draws on statistical distributions for the specific terrain being simulated.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Limited to simulation of terrain characteristics obtained by stochastic draws on the appropriate distributions.

Sidedness: Two-sided, asymmetric; one side is nonreactive.

LIMITATIONS: One weapon firing at one target that does not return fire.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Analytic treatment of terrain and intervisibility and ability for the target to return fire and maneuver.

INPUT: Target vehicle data required includes weight, power train, and traction characteristics. Terrain data required includes surface type, strength, and surface slope. Terrain statistics required are mean "in view" segment length, mean "out of view" segment length, and mean first opening range. Weapon data required includes horizontal and vertical bias and dispersion as a function of range and target speed, time to first shot, and time to subsequent shots. Target data required is a two-rectangle fit of the target at the angle of attack being simulated and range to target at start time.

OUTPUT: Graphs and tables give probability of each shot hitting the vehicle and elapsed time, distance traveled, range, and vehicle speed at shot time. Probability that the vehicle can cross the "in view" segments and not the hit is also tabulated and plotted.

HARDWARE AND SOFTWARE:

Computer:	Cray-XMP, UNIX operating system.
Storage:	Main program - 91594 bytes; pre and post processors - 26300 bytes.
Peripherals:	1 printer, 1 color graphics copier.
Language:	FORTRAN.
Documentation:	Documented as "AMSAA Combat Support Division Interim Note No. C-151" (does not include documentation of statistical treatment of terrain).

SECURITY CLASSIFICATION: Unclassified but weapon and vehicle data is often classified.

GENERAL DATA:
Date Implemented: 1985.

Data Base: Many weapons and vehicles now reside in the data base. New data can be transcribed in a matter of hours, if available. If data is not available, then testing must be done.

CPU time per Cycle: For one replication of the model running one vehicle: 1.94 seconds.

Data Output Analysis: Post processors analyze, condense, plot, and tabulate program output.

Frequency of Use: Extremely variable.

Users: USAMSAA.

Comments: N/A.

TITLE: VIBAS - Village Battle Simulation

MODEL TYPE: Analysis.

PROPONENT: Developed by: Systems Assessment Group, Royal Military, College of Science, Shrivenham, Swindon Wiltshire, SN6 8LA, UK.

On behalf of: CA Department, RARDE, Fort Halstead, Sevenoaks, Kent, UK.

POINT OF CONTACT: (RARDE) Head of CA Department and (RMCS) J. R. Searle, Project Manager, 0793-785309.

PURPOSE: VIBAS was designed as a research and evaluation tool to support the RARDE divisional and battlegroup war games in order to assess the results of combat in villages. It is a highly aggregated model intended to calculate simple battle statistics for reintroduction into the higher-level war games.

DESCRIPTION:

Domain: Land battle.

Span: Intended for North German plain villages.

Environment: Represents village area up to approximate total size of 1500m x 1500m, in terms of component 100m square cells. Terrain features include road network, building density, barriers, and certain defensive preparations.

Force Composition: Up to five attacking armored and infantry forces, each of company group size. Defending infantry forces up to platoon strength with tank and engineer support.

Scope of Conflict: Conventional warfare, daytime only.

Mission Area: Three schematic and generalized types of battles within urban areas, chosen specifically for the RARDE studies that gave rise to VIBAS.

Level of Detail of Processes and Entities: Each attack group modeled as a total number of tanks, APCs, and infantry sections. Defense represented by fireteams (four-man groups) with individual tanks and APCs. Defense deployed to specified squares within village, together with defensive preparations. Attack groups move through the village square by square and will attempt to clear a prespecified proportion of buildings. Assessments are made both within squares and between adjacent squares. These interactions are statistical and highly aggregated. They occur in a fixed sequence and do not consider any spatial orientation or location below square level. It is possible for a user to select the movement routes of attacking forces or for these to be controlled by the computer.

CONSTRUCTION:

Human Participation: Can be run either entirely automatically or with manual selection of major attack movement routes.

Time Processing: Time proceeds on a square-by-square basis. The total time taken to clear a square is calculated the number of buildings cleared and the battle time updated to the point. All attack groups move in parallel formation, one square at a time at the speed of the slowest group.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: Two-sided, asymmetric, both sides reactive within their (different) respective constraints.

LIMITATIONS: Designed to support higher-level games, VIBAS is only intended to generate simple overall time and casualty statistics for a complete village battle; there is no detailed representation of the actual combat processes.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: Force composition, strengths, and starting positions as determined by the state of the parent game.

OUTPUT: Aggregated data on overall time and casualties for reintroduction into parent game. In addition, a square-by-square display of current statistics may be viewed as the model is running. There is also an option to plot a graphical representation of some of these data.

HARDWARE AND SOFTWARE:

Computer:	Hewlett-Packard 9835A desktop computer (minimum 256Kb RAM).
Storage:	150K (flexible disk).
Peripherals:	Disk drive and printer required. Graph plotter optional.
Language:	HP Extended BASIC.
Documentation:	RMCS report OR/C/35, June 1981 - "VIBAS - a simulation to represent combat in villages"; RMCS Report OR/C/38, October 1981 - "VIBAS-2- an enhanced version of a simulation to represent combat in villages"; and RMCS Report OR/C/42, September 1982 - "Operators guide to the VIBAS-3 computer program."

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1982.

Data Base: Approximately 4 hours to create the data files describing the physical shape and characteristics of a new village, and approximately 30 minutes to enter the data required to set up a specific battle on the terrain.

CPU time per Cycle: Depending on the size of the urban area, the battle type chosen, the degree of manual interaction and the type of output selected, could range from 30 seconds to run a whole battle.

Data Output Analysis: None.

Frequency of Use: Not in current use.

Users: (originally) RARDE and RMCS.

Comments: None.

TITLE: VIC - Vector In Commander

MODEL TYPE: Analysis.

PROPONENT: TRAC WSMR, White Sands Missile Range, NM 88002-5502.

POINT OF CONTACT: Mr. Dick Porter or Mrs. Lynda Tonus, (505) 678-1901, AV 258-1901.

PURPOSE: VIC is a computerized, analytical, mid-intensity model developed for use in estimating net assessments, performing force deployment studies, and generating information for performing trade-offs among weapon systems. The outcome of force interactions is determined in terms of the ground gained or lost and the attritions of personnel and weapon systems.

DESCRIPTION:

Domain: Land, air, and space (overhead to land).

Span: Accommodates any theater depending on data base.

Environment: Grid square; representation contains trafficability and intervisibility information.

Force Composition: Joint and combined forces.

Scope of Conflict: Conflict other than strategic nuclear, corps-level, or lower-level conventional conflict.

Mission Area: All conventional missions.

Level of Detail of Processes and Entities: The level of aggregation is the maneuver battalion or its equivalent. It employs forces up to the level of a U.S. corps facing an enemy of strength determined by the scenario and theater in which the simulation takes place. It uses modified differential equations for combat outcomes based upon the VECTOR-2 model. Tactics are supplied by the user to provide flexibility in controlling model processes. Each side may employ maneuver units, weapon systems, and weapons of tactical aircraft, as well as artillery, mines, helicopters, air defense systems, and other means of conducting combat at the U.S. corps level.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Dynamic, time- and event-step.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided.

LIMITATIONS: Currently no nuclear or directed energy weapons portrayal; both under development.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Improvements are planned for nuclear and chemical functional areas and for modeling new weapon systems.

INPUT: Forces and supply inventories, basic weapons performance data, other system performance data, geographic and terrain data, and tactical decision tables.

OUTPUT: Casualties and system losses (killer/victim scoreboards, etc.), FLOT traces and force positions over time, target acquisition and intelligence summaries, availability and condition of forces and supplies, and air battle and air defense results.

HARDWARE AND SOFTWARE:

Computer:	Designed to run on a VAX computer with a VMS operating system.
Storage:	Minimum required: 800,000 blocks.
Peripherals:	CRT, high-speed printer.
Language:	SIMSCRIPT and FORTRAN.
Documentation:	N/A.

SECURITY CLASSIFICATION: Data bases are often classified.

GENERAL DATA:

Date Implemented: 1986.

Data Base: N/A.

CPU time per Cycle: Depends on data base size; can take hours of CPU time to process hours of battle.

Data Output Analysis: Postprocessor aids in analysis output, raw data, graphics display, and time periods.

Frequency of Use: Continuous.

Users: VIC Model Users Group, TRAC.

Comments: Studies agencies and study applications for which the model has been used: AFV, DEEP FIRES, BF90, FAADS, LHX, CAMAA.

TITLE: Visual Search

MODEL TYPE: Analysis.

PROPONENT: WRDC, Avionics Laboratory, Analysis and Evaluation Branch (WRDC/AAWA), Wright-Patterson AFB, OH 45433-6543.

POINT OF CONTACT: Mr. Bill McQuay, (513) 255-2164.

PURPOSE: Visual Search is used to predict the ability of one or more observers to detect an airborne target, typically an aircraft, through visual search. It is an operations support tool that generates a running cumulative probability of detection as a function of time for each target/observer engagement.

DESCRIPTION:

Domain: Air.

Span: Local.

Environment: Sky conditions, ground reflectance, target reflectance, sun angles, and visibility range.

Force Composition: One or more observers; single penetrator target.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Entities consist of a single target and one or more observers. Observers can be characterized as either moving or stationary, on the ground or in the air, and with or without optical aids. The target moves at a given speed in a straight and level flight path until a user-specified target position value is reached. During target motion, the detection probability is computed every one-third of a second. For multiple observers, the cumulative probability is interpreted as the probability that the target is being seen by at least one observer.

CONSTRUCTION:

Human Participation: Can be run interactively or in batch mode.

Time Processing: Dynamic, time-step.

Treatment of Randomness: Detection probability is deterministically based upon target size and contrast with the sky, atmospheric visibility, and sun and observer geometry.

Sidedness: One-sided.

LIMITATIONS: Only a single target can be modeled, and maneuvers are not allowed.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: Target size and contrast, atmospheric visibility, scenario geometry, size of search field, number of observers, and parameters describing optical aids should such aids be employed.

OUTPUT: Matrix showing the target's ground range and associated probability of detection at one-second intervals.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780 operating under VMS.
Storage:	700 blocks.
Peripherals:	One VTxxx terminal, one printer.
Language:	FORTRAN, Ada.
Documentation:	User's manual.

SECURITY CLASSIFICATION: Source code is unclassified. When optical aids are used, parameters for specific systems are generally classified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: N/A.

CPU time per Cycle: 6 CPU seconds (VAX 11/780).

Data Output Analysis: No postprocessor.

Frequency of Use: Varies depending on requirements.

Users: Primarily WRDC/AAWA.

Comments: N/A.

TITLE: VOLUME Engageability Volume Model Graphic Display

MODEL TYPE: Analysis, but also useful for training and education.

PROPONENT: Vitro Corporation, 14000 Georgia Ave., Silver Spring, MD 20906.

POINT OF CONTACT: A. J. Ondrish, (301) 231-2097.

PURPOSE: VOLUME is used to generate and produce slides and viewgraphs for presentations and training programs. It serves as a useful aid for visualizing and understanding missile capability from a spatial point of view.

DESCRIPTION:

Domain: Air; at sea for naval ships.

Span: Worldwide.

Environment: Above sea surface.

Force Composition: Ship with STANDARD Missile (SM) versus a target aircraft or missile.

Scope of Conflict: Conventional.

Mission Area: AAW.

Level of Detail of Processes and Entities: VOLUME generates 3-dimensional (3D) representations of SM simulation results, which are combined with 3D solid modeling techniques to present regions of capability in target crossrange and downrange coordinates. Several graphical formats are available, as is the option of arbitrary points of view.

CONSTRUCTION:

Human Participation: Required.

Time Processing: Static.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided.

LIMITATIONS: Portrays only nondiving targets.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Portrayal of diving targets in addition to nondiving targets.

INPUT: Missile type and target speed.

OUTPUT: Graphics display and hard copies from printer.

HARDWARE AND SOFTWARE:

Computer: HP 9845 C/HP 9020C.

Storage: 150K Bytes.

Peripherals: Roster printer.
Language: HP Rocky Mountain Basic.
Documentation: Notes.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:
Date Implemented: 1984.

Data Base: 1300 lines of code.

CPU time per Cycle: 70 seconds on HP9845C or 15 seconds on HP 9020C.

Data Output Analysis: Hard copy graphics.

Frequency of Use: Occasionally.

Users: Vitro uses VOLUME as an additional analysis tool.

Comments: VOLUME is an excellent graphical tool for engageability studies.

TITLE: WAAM - Worldwide Military Command and Control System (WWMCCS) Allocation and Assessment Model

MODEL TYPE: Analysis of Command, Control Communications (C3)

PROPONENT: Defense Communications Agency.

POINT OF CONTACT: Dr. Crowley, DCA, (202) 692-5023 ~~692-9556.~~

PURPOSE: WAAM has the capability to rapidly assess the emergency action message (EAM) dissemination and performance of the WWMCCS and WWMCCS-based C3 architectures in nuclear stressed environments. It provides a single capability that is responsive to changes (i.e., increases, decreases, improvements, and changes in the U.S. C3 assets) as they may occur and provides a highly credible result. To support the annual SIOP/RISOP war game analysis, WAAM data sets and subroutines are updated to model current MEECN and EAM procedures for executing the SIOP. Numerous simulation excursions are performed to represent varying strategic scenarios and to model adverse conditions that may affect U.S. C3 capabilities. The output from the WAAM functional assessments are analyzed to produce inputs for SINBAC specifying WWMCCS degradation in simulated RED and BLUE nuclear exchanges.

DESCRIPTION: Determines a probability of message receipt by allocation a specified ballistic missile threat to a subset of the WWMCCS as defined by the user, applies the allocation, and determines the direct and collateral damage to the elements of the WWMCCS and outputs a time-ordered probability of damage file. The probabilities of survival or probability of correct message receipts are used in Monte Carlo routines to determine the simulated outcome of specific events. The model uses a networking program with an imbedded Monte Carlo technique.

Domain: Models land-, air-, space-, and sea-based C3 systems.

Span: Global.

Environment: N/A.

Force Composition: BLUE C3 with RED strikes and jamming.

Scope of Conflict: Nuclear.

Mission Area: Strategic connectivity.

Level of Detail of Processes and Entities: Models each communication node and path as well as each threat system.

CONSTRUCTION:

Human Participation: Not required.

Time Processing: Event-step.

Treatment of Randomness: Stochastic, Monte Carlo.

Sidedness: One-sided.

LIMITATIONS: N/A.

PLANNED IMPROVEMENTS AND MODIFICATIONS: N/A.

INPUT: RISOP BLUE Target Base Strike Files Extract for C3 damage; current C3 data base (strategic connectivity master plan data base extract); RISOP high-altitude burst allocation file; C3 systems descriptions/capabilities; and specific case parameters.

OUTPUT: Model output is a single iteration message-routing described in terms of length of time to complete transmission, path of message transmittal, and mode of transmission. This single iteration is replicated a designated number of times to effectively employ the Monte Carlo technique.

HARDWARE AND SOFTWARE:

Computer:	IBM 4341 AND VAX 8700.
Storage:	N/A.
Peripherals:	N/A.
Language:	FORTRAN 77.
Documentation:	WAAM overview and user's guide, Feb 1987; WAAM subroutine documentation, Aug 1986.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: N/A.

Data Base: 1 month.

CPU time per Cycle: 1 month.

Data Output Analysis: 1/2 month.

Frequency of Use: Annual cycle.

Users: J-8, DCA, OSD PA&E, JDSSC.

Comments: N/A.

TITLE: WAM - Weapon Assessment Model

MODEL TYPE: Analysis.

PROPONENT: The BDM Corporation, 7915 Jones Branch Drive, McLean, VA 22102.

POINT OF CONTACT: Edmund J. Bitinas, (703) 848-5246 or John Chalecky, (703) 848-6374.

PURPOSE: WAM is designed to evaluate air-to-surface and surface-to-surface weapon system's capability to defeat a target.

DESCRIPTION:

Domain: Land and sea.

Span: Can accommodate a target array composed of any number of individual elements.

Environment: Elements of the target array exist in a Cartesian coordinate system.

Force Composition: Any mix of forces may be portrayed.

Scope of Conflict: Conventional, advanced conventional, chemical, and nuclear weapons and mines.

Mission Area: Any mission area in which a weapon is used to engage a surface target.

Level of Detail of Processes and Entities: Individual submunitions versus individual target elements (vehicles, personnel, etc.) are considered. Time is not explicitly considered and therefore no processes are explicitly modeled.

CONSTRUCTION:

Human Participation: Not permitted.

Time Processing: Static.

Treatment of Randomness: Weapon hitpoints are determined stochastically through Monte Carlo draws from distributions of delivery system error at all levels (e.g. aircraft delivery error, dispenser ballistic error, and submunition dispersion). Probability of kill for any target element is a function of its distance from the weapon hitpoint. Target element kills are determined in a Monte Carlo fashion based on the computed probability of kill.

Sidedness: One-sided.

LIMITATIONS: Does not consider persistent effects.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Incorporation of algorithms to assess the effects of partial vehicle kills on a combat units overall effectiveness, i.e. interdiction kill methodology.

INPUT: Requirements include the target array, attack system parameters such as target locations errors, system delivery errors, footprint dimensions for smart weapons, and pK curves for different target types within the target array.

OUTPUT: Distributions of the number of target acquisitions (for sensor-fuzed weapons), number of hits on target elements, and number of kills within the target array. Graphic output of a weapon laydown over the target array is also available.

HARDWARE AND SOFTWARE:

Computer:	Runs on the DEC VAX series (VMS), IBM PCs and compatibles (DOS), and the Macintosh family.
Storage:	200 KB.
Peripherals:	No special requirements for analysis purposes. If graphic output is desired, a graphics capable terminal or plotter is required.
Language:	FORTRAN.
Documentation:	A user's manual is available.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: October 1983.

Data Base: Approximately one man-week.

CPU time per Cycle: Depends on size of attack and number of elements in target array. Run-time varies from one minute to twenty minutes on a DEC MicroVAX.

Data Output Analysis: Raw data and summary statistics are provided for ease of interpretation of results.

Frequency of Use: As required; average of six studies per year.

Users: U.S. Air Force, Defense Nuclear Agency, SHAPE Headquarters, Army DCSOPS, commercial concerns.

Comments: Normally employed with other BDM models in a hierarchical modeling approach.

TITLE: WEBS - Weapons Effectiveness Battle Simulation

MODEL TYPE: Analysis.

PROPONENT: CA4 Division, RARDE, Fort Halstead, Sevenoaks, Kent, England.

POINT OF CONTACT: N/A.

u(PURPOSE: The WEBS is used for weapons systems effectiveness studies at the battlegroup level.

DESCRIPTION:

Domain: Land.

Span: Local.

Environment: Lines of sight generated statistically from scenario-dependent indices.

Force Composition: BLUE battlegroup vs. RED regiment. Can be extended quite simply.

Scope of Conflict: Conventional.

Mission Area: Contact battle.

Level of Detail of Processes and Entities:
Entity: Individual vehicles or GW teams.
Processes: Direct Fire - Several classes of weapons (e.g., CLOS, Fire and Forget, and Ripple Fire) represented with separate engagement sequences for each. Lethality is by single shot kill probability.

Artillery - Preplanned missions only. Missions may be smoke, RDMs, illuminating, or lethal.

Minefields - Prelaid or :DMs.

Movement - Normally orthogonal movement only (i.e., only North-South or East-West), with speeds & statuses governed by input-specified orders. Movement is more sophisticated for helicopters.

Acquisition - Detection by random search and by firing, both of which are governed by data curves. Smoke, illuminating and statuses of mover and firer may affect times.

CONSTRUCTION:
Human Participation: Not required.

Time Processing: Event-step.

Treatment of Randomness: Stochastic, Monte Carlo. Controlled random numbers are used to reduce variance.

Sidedness: Two-sided, symmetric.

LIMITATIONS: Poor modeling of movement. Statistical lines of sight make reproducing previous gamed (e.g., using JANUS-qv) situations difficult. No representation of infantry other than GW teams, and no C3I.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None--a completely new model is planned to replace WEBS.

INPUT: Weapon system characteristics; acquisition data; piece "Tactics," i.e., movement speeds, states, etc.; ORBAT and deployment; minefield location and densities; and artillery mission data.

OUTPUT: Many different categories of information, including kill/victim and firer/target tables for each instance of combat and the averages of those instances; shot and kills by range; and trace of each event that occurred within the run, in the form of an ORACLE (a relational data base) table.

HARDWARE AND SOFTWARE:

Computer:	VAX/VMS.
Storage:	??
Peripherals:	None specifically needed.
Language:	FORTRAN IV, reconditioned to FORTRAN 77.
Documentation:	Management summary, model definitions, user guide, and programmer's guide.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1981.

Data Base: At least four man-months for experienced staff, frequently six man-months.

CPU time per Cycle: Typically one minute of CPU time for two minutes of battle time.

Data Output Analysis: Highly variable.

Frequency of Use: Frequent but declining.

Users: CA4 Division, RARDE. TRAC (White Sands Missile Range) has a copy - it is unknown what use they make of it.

Comments: WEBS will be replaced by a new model over the next two to three years.

TITLE: WEIGHT

MODEL TYPE: Analysis.

PROPONENT: U.S. Army Ballistic Research Laboratory, Vulnerability Lethality Division (SLCRR-VL), Aberdeen Proving Ground, MD 21005-5066.
U.S. Army Material System Analysis Activity, Ground Warfare Division (AMXSY-G), Aberdeen Proving Ground, MD 21005-5071

POINT OF CONTACT: James P. Billingsley, (205) 876-5210, AV 746-5210. Ms. Natalie Barker, (301)278-6319, AV 298-6319.

PURPOSE: WEIGHT processes the pK grid data produced by V/L codes such as SLAVE, VAMP, and VAST. It is assumed that there is a normal or gaussian hit distribution with regard to the center of impact location (aimed or biases) in both the horizontal and vertical directions. With this assumption, plus appropriate statistical hit information (aim point, aim point biases, and standard deviations) and the pK grid tables, WEIGHT computes pH, which is the probability of hitting the complete target, and pKss, which is the overall pK given a single aimed shot at the target.

WEIGHT can also compute the following optional information provided appropriate input data is supplied: additional pK results weighted with respect to different parameters such as range or average azimuth; and defilade pK, which is the pK for a target partially shielded or protected by a defilade, revetment, or natural terrain, etc. Hit distribution densities other than the Gaussian could be utilized via appropriate modifications.

DESCRIPTION:

Domain: Land and sea targets.

Span: N/A. WEIGHT is not a war game simulation code.

Environment: N/A.

Force Composition: N/A.

Scope of Conflict: N/A.

Mission Area: N/A.

Level of Detail of Processes and Entities: Different versions exist with somewhat diverse methodology employed to integrate the normal two-dimensional uncorrelated distribution function over the pK grid plane area (projected area of target). This integration cannot be done in closed form so numerical techniques must be employed. The elemental volume between the distribution surface and a grid cell area is the probability that a hit will occur in that particular grid cell. This essential computation which must be performed via a numerical procedure.

CONSTRUCTION:

Human Participation: Required for acquiring and loading the input information.

Time Processing: Static.

Treatment of Randomness: The desired amount of randomness is input via the standard deviations (horizontal and vertical) of the miss distances.

Sidedness: N/A.

LIMITATIONS: Primarily limited to postprocessing the pK grid output produced by land and sea V/L assessment methodologies.

PLANNED IMPROVEMENTS AND MODIFICATIONS: None.

INPUT: pK grid data and appropriate system accuracy information.

OUTPUT: Weighted probability of hit and kill results, usually in tabular form. Various graphical postprocessing is usually employed to visually display the results.

HARDWARE AND SOFTWARE:

Computer:	Will run on a minicomputer such as the HP-9000 series.
Storage:	The code does not present a storage problem, but the pK grid input files could cause one.
Peripherals:	One printer and one graphics unit.
Language:	FORTRAN.
Documentation:	No formal report.

SECURITY CLASSIFICATION: The code is unclassified but certain input may be classified.

GENERAL DATA:

Date Implemented: Mid 1970s.

Data Base: Preparation and acquisition of certain input data can be tedious and time consuming.

CPU time per Cycle: On the order of seconds or minutes, depending on the size of the pK grid table.

Data Output Analysis: The USBRL/AMSAA version performs certain optional postprocessing functions. Normally the results require graphical depiction to facilitate checking and analysis.

Frequency of Use: One to two times a year.

Users: USABRL, USAMSAA, and USAMICOM.

Comments: The WEIGHT code is the third and final portion of the trilogy of simulation codes employed to predict land and sea combat lethality. The preceeding codes in order of employment are geometric code (to produce sotline grid) and V/L code (to produce pK grid data).

Appropriately validated and weighted pK results produced via this methodology may be input to U.S. Army war game simulation codes.

TITLE: XSTAR

MODEL TYPE: Analysis.

PROPONENT: Force Structure, Resource, and Assessment Directorate (J-8), The Joint Staff, The Pentagon, Rm 1D937, Washington, DC 20318-8000.

POINT OF CONTACT: Major K. C. Konwin, J-8 NFAD/SDB, (202) 695-4657, AV 225-4657.

PURPOSE: XSTAR is a systems analysis level model used to investigate various system-level effectiveness measures for strategic defense systems.

DESCRIPTION:
Domain: Land- and space-based kinetic energy weapons and space-based directed energy weapon systems.

Span: Single-sided, worldwide strategic defense engagements.

Environment: Three-dimensional, earth-centered coordinate system.

Force Composition: RED offensive missile threat and BLUE strategic defense system (or vice versa).

Scope of Conflict: Strategic offensive nuclear/defensive exchange analysis.

Miss conflict. Strategic conflict.

Level of Detail of Processes and Entities: Lowest level of engagement is defensive interceptor to re-entry vehicle. Kills are assessed through Monte Carlo techniques using an overall defined probability of kill of the type of engagement and flight phase of the threat element.

CONSTRUCTION:
Human Participation: Analyst selects decision criteria that involve shot selection by the battle manager function. Model can be run interactively via menus, but is usually run in a batch mode.

Time Processing: Dynamic, time-step (increment is user-defined).

Treatment of Randomness: Weapon systems failures and engagement outcomes are assessed through Monte Carlo determination.

Sidedness: One-sided, nonreactive.

LIMITATIONS: Battle manager has perfect global status information on all threat elements. Sensors are only indirectly modeled in discrimination methodology for midcourse.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Port of code to UNIX (SUN 4) environment.

INPUT: Scenario/strike tape of offensive threat, missile parameter file, launch and target site files, computation control file, weapons parameter file, satellite shells file, and ground-launched interceptor file.

OUTPUT: User-defined selection of available output reports.

HARDWARE AND SOFTWARE:

Computer:	VAX 11/780 or better.
Storage:	700 blocks to store executable image; 300 blocks data files; 30 million bytes virtual memory (60,000 pages).
Peripherals:	None required; terminal or line printer for report review.
Language:	VAX FORTRAN.
Documentation:	User's guide.

SECURITY CLASSIFICATION: Secret (undergoing review).

GENERAL DATA:

Date Implemented: 1988.

Data Base: Currently supported by user-generated flat files. Separate effort underway to support the files with INGRES data base calls.

CPU time per Cycle: Depends on launch duration, size of offensive threat, and number of defensive satellites. Typical run times are less than 30 minutes. Five to 15 CPU minutes required for typical representative run (less than 10000 RVs and 500 satellites).

Data Output Analysis: Postprocessor pulls data from output reports into spreadsheet summary files to compare results across multiple runs.

Frequency of Use: Used weekly.

Users: The Joint Staff/J-8 NFAD.

Comments: None.

TITLE: YAC - Yet Another CHEMCAS

MODEL TYPE: Analysis.

PROPONENT: CRDEC, Studies & Analysis Office, Aberdeen Proving Ground, MD 21010-5423.

POINT OF CONTACT: Mr. Richard Saucier, (301) 278-6721, AV 298-6318.

PURPOSE: This program simulates a one-sided battlefield scenario of firing multiple chemical munitions onto a battlefield sector composed of many target elements. Statistics are calculated for chemical agent casualties and area coverage for each of these target elements. The CHEMCAS model served as the basic structure for the development and building of YAC. The two models differ mainly in their casualty assessment techniques.

DESCRIPTION:
Domain: Land.

Span: Target sector.

Environment: Steady-state meteorological conditions for any time of day or night over flat, open terrain, and static battlefield environment for target location and unit operations.

Force Composition: Simulates effects of either BLUE or RED fighting units.

Scope of Conflict: Chemical warfare.

Mission Area: Assesses chemical missions within combat target areas of platoon to battalion size.

Level of Detail of Processes and Entities: High resolution simulation of the chemical pattern laydowns, target positioning, and assessment of target casualties. Effects of MOPP status and changes in MOPP states and breathing rates also evaluated.

CONSTRUCTION:
Human Participation: Not required for decisions and processes after inputs are setup and program executes; internal control makes decisions and runs.

Time Processing: Model takes snapshots of battlefield situation at specific time intervals or periods.

Treatment of Randomness: The model assumes uniform random distribution of impacts over the targeted area. This assumption is more appropriate for mass firing of RED on BLUE targets, but the reverse can also be assessed. NUSSE3 serves as the deterministic single munition cloud generator.

Sidedness: Program simulates a one-sided battlefield scenario.

LIMITATIONS: The model is limited to steady-state MET conditions over flat, open terrain. The impact generator does not realistically simulate individual munition delivery errors. There are no off-target effects assessments. A

limited agent toxicity data base is built into the model. The program remains in a state of initial development, and has served as a research model that has had limited testing and verification of results.

PLANNED IMPROVEMENTS AND MODIFICATIONS: No plans for improvements, modifications, or further testing of this program exist.

INPUT: Sector size, size of each subtarget element within the sector, a grid of dosage and deposition values from the single munition source generator NUSSE, breathing rates and MOPP states of each target element, and the number of rounds fired at each target element.

OUTPUT: Statistics on the percent of expected casualties and percent area coverage for each target element are graphically displayed on the console and printed out in tabular form.

HARDWARE AND SOFTWARE:

Computer:	Generalized design and coding permits model to be run on several computers, such as VAX, UNIVAC, IBM, and IBM PC compatible type computer systems.
Storage:	Approximately 9000 lines of code.
Peripherals:	Minimum requirement: one printer.
Language:	ASCII Standard FORTRAN 77.
Documentation:	There is no technical report that documents this methodology, but a small pamphlet exists that serves as a user's guide.

SECURITY CLASSIFICATION: Unclassified, but some data bases, which serve as inputs, may be classified.

GENERAL DATA:
Date Implemented: 1986.

Data Base: Setting up of a sector target array is time-consuming. However, standardized scenarios exist. Time required for setting up of the NUSSE3 cloud inputs depends on availability of agent and munition parameters. Data setup time requirements can vary from minutes to hours.

CPU time per Cycle: The YAC program consists of four separate and independently run modules. Output from one serves as input to the next module in the sequence. The total time for completing an initial run of the YAC series modules may take from one hour to a half a day.

Data Output Analysis: No postprocessor to analyze the output results.

Frequency of Use: Program has become outdated and rarely used. It is being replaced by the newly improved PARACOMPT and MCAS (version of Tech/Map currently being developed within our office) models.

Users: CRDEC.

Comments: None.

APPENDIX A

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

NAME	MEANING
A/C	Aircraft
AA	Anti-aircraft
AAA	Anti aircraft Artillery
AAFCE	Allied Air Forces, Central Europe (NATO)
AAM	Air-to-Air Missile
AAMRL	Armstrong Aerospace Medical Research Laboratory (AFSC)
AAW	Anti-air Warfare
ABM	Antiballistic Missile
ACC	Air Component Commander
ACE	Allied Command Europe
ADA	Air Defense Artillery
ADAGE	Air Defense Air-to-Ground Engagement Simulation
AD/EN	Armament Division Engineering and Analysis
ADI	Air Defense Initiative
AFAL	Air Force Avionics Laboratory (Wright-Patterson AFB)
AFCENT	Allied Forces, Central Europe
AFCSA	Air Force Center for Studies and Analyses
AFEWC	Air Force Electronic Warfare Center
AFIT	Air Force Institute of Technology
AFNORTH	Allied Forces, Northern Europe
AFOTEC	Air Force Operational Test and Evaluation Center
AF/SA	Air Force Studies and Analysis
AFSC	Armed Forces Staff College

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
AFSOUTH	Allied Forces, Southern Europe
AFSPACECOM	Air Force Space Command
AFWAL	Air Force Wright Aeronautical Laboratories
AFWL	Air Force Weapons Laboratory
AGZ	Actual Ground Zero
AHS	Arlington Hall Station
AI	Airborne Interceptors
AI	Air Interdiction
AIWS	Advanced Interdiction Weapon System
AJ	Antijam
ALCM	Air-Launched Cruise Missile
AMORD	Advanced Mission-Oriented Resource Display
AMSAA	Army Materiel Systems Analysis Activity
AOA	Amphibious Operations Area
APC	Armored Personnel Carrier
APOD	Aerial Port of Debarkation
APP	Antipotential Potential
ARMTE	Army Materiel Test and Evaluation
AR/I	Armed Recon/Interdiction
AS	Air-to-Surface
AS	Articulation Score
ASAT	Antisatellite
ASCM	Antiship Cruise Missile

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
ASD	Aeronautical Systems Division, Wright-Patterson AFB
ASD	Aircraft Statistical Data
ASK	Amplitude Shift Keying
ASL	Atmospheric Sciences Laboratory
ASMD	Antiship Missile Defense
ASP	Ammunition Supply Point
ASU	Antisurface Warfare
ASUW	Antisurface Warfare
ASW	Antisubmarine Warfare
ATAF	Allied Tactical Air Force (NATO)
ATF	Advanced Tactical Fighter
ATO	Air Tasking Order
AWACS	Airborne Warning and Control System
BAI	Battlefield Air Interdiction
BCTP	Battle Command Training Program
BDA	Battle Damage Assessment
BER	Bit Error Rate
BRL	Ballistics Research Laboratory
BSTS	Boost Surveillance and Tracking System
C-E	Communications-Electronics
C2	Command and Control
C3	Command, Control, and Communications
C3I	Command, Control, Communications, and Information

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
C3I	Command, Control, Communications, and Intelligence
CA	Counter Air
CAP	Combat Air Patrol
CAS	Close Air Support
CATA	Combined Arms Training Activity
CDB	Communications Needline Data Base
CDRL	Contract Deliverable Requirements List
CECOM	Communications-Electronics Command
CEI	Communications-Electronics Instruction
CENTAG	Central Army Group, Central Europe (NATO)
CEP	Circular Error Probable
CEWI	Combat Electronic Warfare Intelligence
CFC	Combined Forces Command
CG	Guided Missile Cruiser
CIA	Central Intelligence Agency
CINC	Commander-in-Chief
CINCMAC	Commander-in-Chief, Military Airlift Command
CINCPAC	Commander-in-Chief, Pacific Command
CLOS	Clear Line of Sight
CM/CCM	Countermeasure/Counter-Countermeasure
CMIA	Captured or Missing in Action
CNA	Center for Naval Analyses
CNR	Combat Net Radio

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
COEA	Cost and Operational Effectiveness Analysis
COM	Communication
COM-GEOM	Combinational Geometry
COMINT	Communications Intelligence
CONUS	Continental United States
CP	Central Processing
CPX	Command Post Exercise
CRAD	Contracted Research and Development
CRAF	Civil Reserve Air Fleet
CRC	Constant Radius of Curvature
CRDEC	Chemical Research, Development and Engineering Center
CRT	Cathode Ray Tube
CSA	Close Support Area
CSGP	Computer Support Group
CSS	Combat Service Support
CV	(Aircraft) Carrier Vehicle
DA	Department of the Army
DAC	Douglas Aircraft Company
DAP	Data Analysis Package
DARPA	Defense Advanced Research Projects Agency
DCA	Defensive Counter Air
DCA	Dual Capable Aircraft
DCSOPS	Deputy Chief of Staff Operations

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
DD	Destroyer
DDG	Guided Missile Destroyer
DF	Direction Finder
DGZ	Designated Ground Zore
DGZ	Designated Ground Zero
DIA	Defense Intelligence Agency
DMA	Defense Mapping Agency
DNA	Defense Nuclear Agency
DNBI	Disease or Nonbattle Injury
DOA	Direction of Arrival
DODIC	Department of Defense Identification (or Item) Code
DOF	Degrees of Freedom
DOSVEC	Dosage Vectors
DPG	Dugway Proving Ground
DRCS	Defence Research Centre Salisbury
DREO	Defense Research Establishment Ottawa
DTED	Digital Terrain Elevation Data
DTNSRDC	David W. Taylor Naval Ship Research and Development Center
EAM	Emergency Action Message
EC	Electronic Combat
ECAC	Electromagnetic Compatibility Analysis Center
ECCM	Electronic Counter-Countermeasure
ECDES	Electronic Combat Digital Evaluation System

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
ECECE	Electronic Combat Equipment Capabilities Evaluation
ECM	Electronic Countermeasure
EGA	Enhanced Graphics Adapter
ELF	Extremely Low Frequency
ELINT	Electronic Intelligence
ELS	Emitter Location System
EMSA	EW Multiple Sensors Analysis Package
EO	Electro-Optic
EOH	Equipment on Hand
EO/IR	Electro-Optic/Infrared
EPLRS	Enhanced Position Location Reporting System
ERIS	Exoatmospheric Re-entry Interceptor System
ERP	Effective Radiated Power
ERT	Execution Reference Time
ESM	Electromagnetic Support Measures
EUCOM	European Command
EW	Electronic Warfare
EW/GCI	Early Warning/Ground Control Interceptor
EWL	Electronic Warfare Laboratory
FASTALS	Force Analysis Simulation of Theater Administration and Logistics Support
FC/DNA	Field Command, Defense Nuclear Agency
FCS	Fire Control System
FEBA	Forward Edge of the Battle Area

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
FF	Frigate
FFG	Guided Missile Frigate
FIBUA	Fighting In Built Up Areas
FLOT	Forward Line of Own Troops (interchangeable with FEBA)
FORSCOM	U.S. Forces Command
FPD	Final Preparation and Deployment
FSD	Full-Scale Development
FTX	Field Training Exercise
FYDP	Five Year Defense Program
GBR	Ground-Based Radar
GCI	Ground Control Intercept
GKS	Graphics Kerning System
GLI	Gain Loss Indicator
GSTS	Ground Surveillance and Tracking System
GTRI	Georgia Tech Research Institute
GW	Guerilla Warfare
HEDI	High Endoatmospheric Defensive Interceptor
HOB	Height of Burst
HUMINT	Human Intelligence
I/O	Input/Output
IAG	Interactive Gaming
ICBM	Intercontinental Ballistic Missile
IDA	Institute for Defense Analysis

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
IEW	Intelligence and Electronic Warfare
IFF	Identification Friend or Foe
IFM	Instantaneous Frequency Measurement
IMINT	Imagery Intelligence
IR	Intercept Receiver
IR	Infrared
IRAD	Internal Research and Development
IRBM	Intermediate Range Ballistic Missile
ITW&A	Integrated Tactical Warning and Assessment
J-8	Force Structure, Resource, and Assessment Directorate
J/S	Jammer/Signal (ratio)
JCL	Job Control Language
JDLNET	Joint Directors of Laboratories Network
JDSSC	Joint Data Systems Support Center
JEWC	Joint Electronic Warfare Center
JHU/APL	John Hopkins University/Applied Physics Laboratory
JIC	Joint Intelligence/Information Center
JINTACCS	Joint Interoperability of Tactical Command and Control System (Program)
JOPS	Joint Operation Planning System
JRAD	Joint Resources Assessment Data
JSD	Joint Study Group
JSPS	Jcint Strategic Planning System
JTCG	Joint Technical Coordinating Group

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
JWC	Joint Warfare Center
KEE	Knowledge Engineering Environment
KIA	Killed in Action
LABCOM	U.S. Army Laboratory Command
LADAR	Laser Detection and Ranging
LANTIRN	Low-Altitude Navigation and Targeting Infrared System for Night
LAT/LONG	Latitude/Longitude
LIC	Low-Intensity Conflict
LINK-11	UHF or MHF Digital Data Link (NTDS)
LO	Low Observables
LOC	Line of Communication
LOS	Line of Sight
LRU	Line Replaceable Unit
LSA	Logistic Support Analysis
MAC	Military Airlift Command
MACOM	Major Command
MAPS	Model Analysis Programs
MAWLOGS	Models of the Army Worldwide Logistics System
MCAIR	McDonnell Aircraft Company
MCTBF	Mean Calendar Time Between Failure
MDR	Median Detectable Range
MEB	Marine Expeditionary Brigade
MEF	Marine Expeditionary Force

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
MET	Meteorological
MHE	Mechanized (or Materials) Handling Equipment
MICOM	Missile Command
MIDAS	Macintosh Interactive Display System
MIRV	Multiple Independent Re-entry Vehicle
MMI	Man-Machine Interface
MOA	Memorandum of Agreement
MOE	Measure of Effectiveness
MOPP	Munition-Oriented Protected Posture
MORSA	Movement Requirements for Staff Planning and Special Studies Applications
MOS	Minimum Operating Strip
MOU	Memorandum of Understanding
MOUT	Military Operations on Urbanized Terrain
MS	Master System
MSE	Mobile Subscriber Equipment
MSIC	Missile and Space Intelligence Center
MTI	Moving Target Indicator
MTM	McClintic Theater Model
MTR	Mean Restoral Time
MVS	Multiple Virtual Storage
NAAW	NATO Anti-air Warfare
NAP	Non-nuclear Armament Plan
NASA	National Aeronautics and Space Administration

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
NATO	North Atlantic Treaty Organization
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NBC	Nuclear, Biological, Chemical
NCAA	Non-nuclear Consumables Annual Analysis
NCS	Node Central Switch
NCS	NORAD Computer System
NDU	National Defense University
NEA	Northeast Asia (refers primarily to Korea)
NFAD	Nuclear Forces Analysis Division
NOFORN	Not Releasable to Foreign Nationals
NORAD	North American Air Defense Command
NORTHAG	Northern Army Group, Central Europe (NATO)
NOSC	Naval Ocean Systems Center
NRDEC	Natick Research Development and Engineering Center
NRL	Naval Research Laboratory
NSA	National Security Agency
NSN	National Stock Number
NSNF	Nonstrategic Nuclear Forces
NSPO	NATO Sea Sparrow Program Office
NSWC	Naval Surface Warfare Center
NTB	National Test Bed
NTC	National Training Center

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
NUSC	Naval Underwater Systems Center
NWC	Naval War College
NWC	Naval Weapons Center
O&M	Operations and Maintenance
OA	Operations Analysis
OASD/PA&E	Office of the Assistant Secretary of Defense/Program Analysis and Evaluation
OCA/AI	Offensive Counterair, Artificial Intelligence
OMNIBUS	USA Operational Readiness Study
ONC	Operational Navigational Chart
OPFAC	Operational Facility
OPLAN	Operation Plan
OSD	Office of the Secretary of Defense
OSD/NA	Office of the Secretary of Defense, Office of Net Assessment
OT&E	Operational Test and Evaluation
OTSG	Office of the Surgeon General (Army)
PACAF	Pacific Air Forces
PACOM	Pacific Command
PD	Pulse Doppler
PGS	Professional Graphics System
pH	Probability of Hit
pK	Probability of Kill
PLL/ASL	Prescribed Load List/Authorized Stockage List

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
PLRS	Position Location Reporting System
PLS	Prelaunch Survivability
PMCS	Professional Military Comptroller School
PMTC	Pacific Missile Test Center
POC	Point of Contact
POD	Port of Debarkation
POE	Port of Embarkation
POL	Petroleum, Oil, and Lubricants
POMCUS	Prepositioned Material Configured for Unit Set
POPMO	Phase I Program Office
PRF	Pulse Repetition Frequency
pS	Probability of Survival
PTP	Probability of Penetration
R&D	Research and Development
RADC	Rome Air Development Center
RAM	Random Access Memory
RAM	Reliability, Availability, and Maintainability
RARDE	Royal Armaments Research and Development Establishment
RCS	Radar Cross Section
RDD	Required Delivery Date
RDT&E	Research, Development, Test, and Evaluation
RF	Radio Frequency
RF/EO	Radio Frequency/Electro-Optic

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
RPV	Remotely Piloted Vehicle
RV	Re-entry Vehicle
SAC	Strategic Air Command
SAG	Surface Action Group
SAM	Surface-to-Air Missile
SAR	Search and Rescue
SBICV	Space-Based Interceptor Carrier Vehicle
SBL	Space-Based Laser
SCL	Standard Conventional Weapons Load
SCORES	Scenario Oriented Recurring Evaluation System
SDI	Space Defense Initiative
SDIO	Strategic Defense Initiative Organization
SDS	Strategic Defense System
SEACOP	Strategic Sealift Contingency Planning System
SEAD	Suppression of Enemy Air Defense
SEN	Small Extension Node
SHAPE	Supreme Headquarters, Allied Powers Europe
SHORAD	Short-Range Air Defense
SIDAC	Single Integrated Damage Analysis/Assessment Capability
SIGINT	Signals Intelligence
SIMAN	Simulation Analysis Language by Systems Modeling Corporation
SINCGARS	Single Channel Ground and Air Radio System
SIOP	Single Integrated Operation Plan

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
SIOP/RISOP	Single Integrated Operation Plan/Russian Integrated Strategic Operational Plan
SLAM	Standoff Land Attack Missile
SLBM	Submarine-Launched Ballistic Missile
S/N	Signal to Noise
SOF	Special Operations Forces
SOS	Squadron Officer School
SPAWAR	Space Warfare Systems Command
SPOD	Sea Port of Debarkation
SRAM	Short Range Attack Missile
SRC	Standard Requirements Code
SRI	Spectral Radiant Intensity
SRT	Strategic Relocatable Targets
SRU	Shop Replaceable Unit
SS-N	Surface-to-Surface Naval (followed by weapon type)
SSPD	Single-Shot Probability of Damage
SSTS	Space Surveillance and Tracking System
STAFF	Stellar Acquisition Feasibility Flight
STC	SHAPE Technical Centre
STW	Strike Warfare
SWA	Southwest Asia
TAC	Tactical Air Command
TACC	Tactical Air Control Center
TACNUC	Tactical Nuclear

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
TASM	Tomahawk Antiship Cruise Missile
TAT	Turnaround Time
TAWC	Tactical Air Warfare Center
TBM	Tactical Ballistic Missile
TCAC	Technical Control and Analysis Center
TECOM	Test and Evaluation Command
TEWA	Threat Evaluation and Weapon Assignment
TFE	Transportation Feasibility Estimator
TOA	Time of Arrival
TOE	Table of Organization and Equipment
TOLS	Take-Off and Landing Surfaces
TPFDD	Time-Phased Force and Deployment Data
TPTRL	Time-Phased Transportation Requirements List
TRAC	TRADOC Analysis Command
TRADOC	U.S. Army Training and Doctrine Command
TSA	Technical
TTR	Target Tracking Radar
TUCHA	Type Unit Data File (SDF)
TW/AA	Tactical Warning/Attack Assessment
UKAIR	United Kingdom Air Forces
USABRL	U.S. Army Ballistic Research Laboratory
USACAA	U.S. Army Concepts Analysis Agency
USAEPG	U.S. Army Electronic Proving Grounds

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
USAFE	U.S. Air Force Europe
USAFETAC	U.S. Air Force Environmental Technical Applications Center
USAFSTC	U.S. Army Foreign Science and Technology Center
USALEA	U.S. Army Logistics Evaluation Agency
USAMC	U.S. Army Materiel Command
USAMICOM	U.S. Army Missile Command
USAREUR	U.S. Army, Europe (Heidelberg, Germany)
USASDC	U.S. Army Strategic Defense Command
USCENTCOM	U.S. Central Command
USCG	U.S. Coast Guard
USCINCPAC	Commander-in-Chief, U.S. Pacific Command
USCINCPACFLT	Commander-in-Chief, U.S. Pacific Fleet
USCINCSPACE	Commander-in-Chief, U.S. Space Command
USMC	U.S. Marine Corps
USSPACECOM	U.S. Space Command
UV	Ultraviolet
V&V	Verification and Validation
V/L	Vulnerablility and Lethality
VMI	Video Microcomputer Interface
WESTCOM	U.S. Army Western Command
WIA	Wounded in Action
WOC	Wing Operations Center
WOT	Weapons on Target

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(cont'd.)

NAME	MEANING
WPC	Warrior Preparation Center
WRALC	Warner Robins Air Logistics Center
WRDC	Wright Research and Development Center
WRM	War Reserve Material
WSEG	Weapon System(s) Evaluation Group
WSMR	White Sands Missile Range
WWMCCS	Worldwide Military Command and Control System

APPENDIX B

DATA COLLECTION INFORMATION

DATA COLLECTION INFORMATION

FORMAT TO SUBMIT REVISIONS OR NEW ENTRIES

To simplify your task of submitting new entries or revising existing ones, a blank data collection sheet is provided on the next page. It is recommended that you use copies of this form when making revisions or creating new entries. Instructions for completing the data collection sheet and a brief description of each category are provided at the end of this appendix.

Please send all submissions to:

Force Structure, Resource, and Assessment Directorate (J-8)
The Joint Staff
The Pentagon
Rm 1D 929B
Washington, DC 20318-8000
Attention: Lieutenant Commander N. L. Hackney, USN
(202) 693-4604, AV 223-4604

BLANK DATA COLLECTION SHEET

TITLE:

MODEL TYPE:

PROPONENT:

POINT OF CONTACT:

PURPOSE:

DESCRIPTION:
Domain:

Span:

Environment:

Force Composition:

Scope of Conflict:

Mission Area:

Level of Detail of Processes and Entities:

CONSTRUCTION:
Human Participation:

Time Processing:

Treatment of Randomness:

Sidedness:

LIMITATIONS:

PLANNED IMPROVEMENTS AND MODIFICATIONS:

INPUT:

OUTPUT:

HARDWARE AND SOFTWARE:
Computer:
Storage:
Peripherals:
Language:
Documentation:

SECURITY CLASSIFICATION:

GENERAL DATA:

Date Implemented:

Data Base:

CPU time per Cycle:

Data Output Analysis:

Frequency of Use:

Users:

Comments:

Please send new entries or revisions to:

Force Structure, Resource, and Assessment Directorate (J-8)
The Joint Staff
The Pentagon
Rm 1D 929B
Washington, DC 20318-8000
Attention: Lieutenant Commander N. L. Hackney, USN
(202) 693-4604, AV 223-4604

DATA COLLECTION SHEET INSTRUCTIONS

TITLE: Full name followed by acronym.

MODEL TYPE:
Choose either ANALYSIS, e.g., models which serve as theoretical, conceptual tools for understanding and improving strategy or TRAINING AND EDUCATION, e.g., models aimed at improving actual troop performance or at providing lifelike experiences for the sake of educating users.

PROPONENT: Organization primarily responsible for maintaining model.

POINT OF CONTACT: List name and phone number of person from whom additional information may be obtained.

PURPOSE:
This section should contain a brief narrative covering the following elements:

A. If ANALYSIS, is it a RESEARCH & EVALUATION TOOL or an OPERATION SUPPORT TOOL (DECISION AID)?

1. If RESEARCH & EVALUATION TOOL, does it:

   a. deal with WEAPONS SYSTEMS? If so, does it deal with (a) SYSTEMS DEVELOPMENT or (b) SYSTEMS EFFECTIVENESS against targets and their efficient mix with support systems?

   OR b. deal with FORCE CAPABILITY AND REQUIREMENTS? If so, does it deal with (a) COURSES OF ACTION ASSESSMENT, (b) MIX, (c) EFFECTIVENESS, or (d) RESOURCES PLANNING?

   OR c. deal with COMBAT DEVELOPMENT? If so, does it deal with (a) CURRENT OR NEW DOCTRINE, (b) COMPETING STRATEGIES, or (c) POLICY STUDY?

2. If OPERATIONS SUPPORT TOOL (DECISION AID) there are no further sub-classifications.

B. If TRAINING AND EDUCATION, is model used for SKILLS DEVELOPMENT or as an EXERCISE DRIVER?

1. If for SKILLS DEVELOPMENT, does it develop the skills of (a) a TEAM or (b) an INDIVIDUAL?

2. If an EXERCISE DRIVER, is it (a) a FIELD TRAINING EXERCISE DRIVER, (b) a COMMAND POST EXERCISE DRIVER, (c) a SEMINAR EXERCISE DRIVER, or (d) an INDIVIDUAL EXERCISE DRIVER?

DESCRIPTION:
In this section you will classify the model according to its qualities, which are the real entities and processes that the model represents. (Use only short answers to complete this section.)

A. DOMAIN: The physical or abstract space in which the entities and processes operate. Can be land, sea, air, space, undersea, a combination of any of the above, or an abstract domain.

B. SPAN: Scale, e.g., global, theater, regional, local, or individual.

C. ENVIRONMENT: Texture or detail, e.g., terrain relief, weather, time of day, terrain cultural features (such as cities or farmland), and sea states.

D. FORCE COMPOSITION: Mix of forces which can be portrayed by the model, e.g., combined forces, joint forces, component, element, etc.

E. SCOPE OF CONFLICT: Category of weapons, e.g., conventional, unconventional, chemical, biological, nuclear, chemical-biological-nuclear, special, and rear-area (either Red or Blue).

F. MISSION AREA: Recognized combinations of weapons and procedures used to accomplish a specific objective, e.g., sea control, close air support, airlift, and indirect artillery.

G. LEVEL OF DETAIL OF PROCESSES AND ENTITIES: Entity: What is lowest entity modeled? Can be, e.g., anything from a numbered air force unit to an individual aircraft, from an army to a single soldier, or from an individual tank to a task force. Processes such as attrition, communications, and movement affect the above entities. The description of the level of detail must contain qualifiers that address the processes in the model.

CONSTRUCTION: (Use only short answers to complete this section.)

A. HUMAN PARTICIPATION: REQUIRED or NOT REQUIRED?

1. If REQUIRED, is HUMAN PARTICIPATION (a) FOR DECISIONS, (b) FOR PROCESSES, or (c) FOR BOTH?

   a. If REQUIRED FOR DECISIONS, does it (a) WAIT FOR A DECISION or (b) CONTINUE TO RUN WITHOUT A DECISION (e.g., SIMULATORS)?

2. If NOT REQUIRED, (a) is the model INTERRUPTABLE, (b) does it have SCHEDULED CHANGES, or (c) is human participation NOT PERMITTED?

B. TIME PROCESSING: Is model DYNAMIC (treats time-dependent processes) or STATIC (no dependence on time)?

1. If DYNAMIC, is it (a) TIME STEP, (b) EVENT STEP, or (c) CLOSED FORM?

2. If STATIC, there are no further sub-classifications.

C. TREATMENT OF RANDOMNESS: Is model STOCHASTIC or DETERMINISTIC?

1. If STOCHASTIC, is it (a) DIRECT COMPUTATION or (b) MONTE CARLO?

2. If DETERMINISTIC, (a) does it GENERATE A VALUE AS A FUNCTION OF AN EXPECTED VALUE or (b) is it BASICALLY DETERMINISTIC (NO RANDOMNESS)?

D. SIDEDNESS: HOW MANY COLLECTIONS OR ALLIANCES OF RESOURCES ARE WORKING IN OR THROUGH THE MODEL TOWARD A COMMON GOAL?

1. If ONE-SIDED, there are no further sub-classifications.

2. If TWO-SIDED, is it (a) SYMMETRIC or (b) ASYMMETRIC?

   a. If SYMMETRIC, there are no further sub-classifications.

   b. If ASYMMETRIC, (a) is ONE SIDE NONREACTIVE or (b) are BOTH SIDES REACTIVE?

3. If THREE- OR MORE-SIDED, is it (a) SYMMETRIC or (b) ASYMMETRIC?

   a. If SYMMETRIC, there are no further sub-classifications.

   b. If ASYMMETRIC, (a) is ONE OR MORE SIDES NONREACTIVE or (b) are ALL SIDES REACTIVE?

LIMITATIONS: For example, number of targets, no geography, etc.

PLANNED IMPROVEMENTS/MODIFICATIONS:

INPUT:
For example, scenario, weapons characteristics, troop unit size, arrival dates.

OUTPUT: Computer printouts, plots, raw data, statistically analyzed data.

HARDWARE AND SOFTWARE:
Computer(OS): Type of computer and operating system

Storage: Minimum storage required

Peripherals: Printers, graphics plotters, etc.

Programming Language:

Documentation: Include DDC accession numbers if assigned

SECURITY CLASSIFICATION: Model without data

GENERAL DATA:
Date Implemented:

Data Base: time needed to prepare data base

CPU Time per Cycle:

Data Output Analysis:

GENERAL DATA (continued):

Frequency of Use:

Users: List primary organizations which have or are using the model

Comments: Supercessions, linkage of model to other models, etc.

NOTES:

1. The data for a single entry should not exceed two pages. There should be no more than 55 lines per page and 79 spaces per line.

2. Data contained in this summary must be unclassified.

APPENDIX C

SIMTAX: A TAXONOMY FOR WARFARE SIMULATION

SIMTAX

A Taxonomy for Warfare Simulation

Workshop Report
(14 -16 October 1986)
(9 - 10 December 1986)
(10 - 11 February 1987)

Dr Lowell Bruce Anderson, Institute for Defense Analyses
Lt Gen John H. Cushman, USA Ret
Dr Alan L. Gropman, SYSCON Corporation
Vincent P. Roske, Jr, Joint Staff J-8

This Military Operations Research Society workshop report faithfully summarizes the findings of a series of three short meetings of experts, users, and parties interested in the subject area. While it is not generally intended to be a comprehensive treatise on the subject, it does reflect the major concerns, insights, thoughts, and directions of the participants at the time of the meetings.

The Military Operations Research Society, Inc.

The Military Operations Research Society is a professional society incorporated under the laws of Virginia for the purpose of enhancing the quality and effectiveness of military operations research. The Society conducts a classified symposium and several workshops annually. It publishes proceedings, monographs and a quarterly bulletin, PHALANX, for professional exchange and peer criticism among students, theoreticians, practitioners and users of military operations research. The Society does not make or advocate official policy nor does it attempt to influence the formulation of policy. Matters discussed or statements made in the course of MORS symposia and other meetings or printed in its publications represent the opinions of the authors and not the Society.

CONTENTS

APPENDICES

FIGURES AND TABLES

I. BACKGROUND

The Department of Defense needs a wargaming and warfare simulation descriptive framework to guide the development, acquisition and use of models of warfare. The essential first step in producing such a descriptive framework is developing a wargaming and warfare simulation taxonomy or classification system.

A wargaming taxonomy would do more, however, than undergird a framework, a classification system would form an indispensable foundation for building a practical catalogue of conflict models and simulations. In the past, the lack of a useful taxonomy for classifying models has reduced the utility of such documents as the Joint Analysis Directorate's[1] "Catalog of Wargaming and Military Simulation Models." The only defined classification (really categorization) system used in this extensive volume is an alphabetical listing by model name. An accepted taxonomy, however, could lead to a catalogue that classified (and thus indexed and cross-indexed) its numerous models by how they were used, what they addressed, and how they were constructed.

Recognizing the basic need for constructing a taxonomy, the Military Operations Research Society sponsored a workshop series, all hosted by the SYSCON Corporation and all led by Mr Vincent P. Roske, Jr, Scientific and Technical Advisor, Force Structure, Resource and Assessment Directorate (J-8) of The Joint Staff. (Workshop attendees are listed in Appendix C.) Workshop attendees developed the warfare simulation taxonomy addressed below which they believe will be valuable for:

1. classifying warfare simulations,
2. constructing frameworks for comparing conflict models,
3. providing the foundation for a comprehensive wargames catalogue.

The workshop focused entirely on warfare simulations and did not devote attention to developing a classification system for other types of models, such as engineering models for weapons development, etc.

Two terms--"model" and "simulation"--have appeared repeatedly above and will recur continually below, and both need to be defined.

1. A model is a representation of a system
2. A simulation is:
    a. a model
    b. the exercise of a model
    c. a Monte Carlo model

The four definitions of simulation are listed in order of preference and all are acceptable to mainstream wargamers (as acceptable as four definitions for a single word would be if found in a dictionary). In this paper, model and simulation are used interchangably. Thus warfare simulation means a model of warfare or any part of warfare for any purpose (such as analysis or training).

It is important here, moreover, to point out the differences between a taxonomy and a catalogue. The former, a classification system, if it is valid, is an indispensable foundation for the latter, a collection of descriptions. But a taxonomy will not provide all the useful information one might want to know about a conflict model being described. Think for a minute about Charles Darwin's taxonomy of kingdom, phylum, class, order, family, genus and species. Marine biologists classify oysters though seven Darwinian levels without telling one that the marine, bivalve, mollusk

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1 Now the Force Structure, Resource and Assessment Directorate (J-8) of The Joint Staff.

from the family Ostreidae are tasty and that a dozen of them cost about $8.00 at Clydes. A taxonomy provides the basis for classifying objects (such as an oyster or a warfare simulation) for identification, retrieval and research purposes and a catalogue provides additional, valuable information (such as set up time, running time, developer, point of contact, etc.)

With these ideas in mind, early workshop discussions were concerned with discovering the fundamental attributes and structures common to warfare simulations. Initial exchanges were based on a paper delivered by Lieutenant General John H. Cushman (USA-Retired) titled "On Representing Warfare." This paper was the product of a collective effort, sponsored by the Joint Analysis Directorate, by General Cushman, Wayne Hughes, Sam Parry and Michael Sovereign. The discussion that followed Gen Cushman's remarks provided insights which suggested that a classification system, or taxonomy, could be developed for warfare simulations.

The conference concluded that a taxonomy for warfare simulations needed to address three equally important, relational (as opposed to hierarchical) dimensions: the *purpose*, the *qualities* and the *construction* of the model or simulation. These three dimensions taken together were thought to be sufficient for classifying models, as is Darwin's taxonomy for classifying animals, but, while all three dimensions have beneath them subdivisions, each dimension is independent of the others. That is to say the entities found under any one dimension are not found under either of the other two dimensions. Unquestionably, however, the three dimensions are functionally related for one would find it impossible to describe clearly a model by reference to only one dimension of the warfare simulation taxonomy.

II. CLASSIFICATION BY PURPOSE

Describing the purpose of a warfare simulation explains why the model was built or to what use the model is being (or could be) applied. For example, the purpose of the SOTACA (State of the Art Contingency Analysis) model is analysis. Note that describing SOTACA's purpose says nothing about SOTACA's qualities nor about its construction (that is, what entities and processes are characterized).

Of course, models may be used for more than one purpose, but, this no more invalidates purpose as one dimension of the taxonomy than listing the numerous uses for a baseball bat might invalidate the definition one finds for that object in a dictionary. SOTACA's primary purpose is analysis, it could also be used for training. Most conflict models, however, can be described as having one purpose or the other. The workshop decided that model or simulation purpose could be subdivided into two major divisions: analysis or training and education (see Figure 1).

Analysis can be further subdivided into two branches, Research and Evaluation Tools, and Operations Support Tools (Figure 1). The Research and Evaluation Tools category can also be subdivided (see Figure 2) into categories dealing with Weapons Systems, that is, Systems Development or Systems Effectiveness against targets and their efficient mix with support systems. The taxonomy places force capability assessment and combat development applications in the Research and Evaluation category. "Combat Development" examines current doctrine, explores new doctrine, evaluates competing strategies or tactics, or studies various policies.

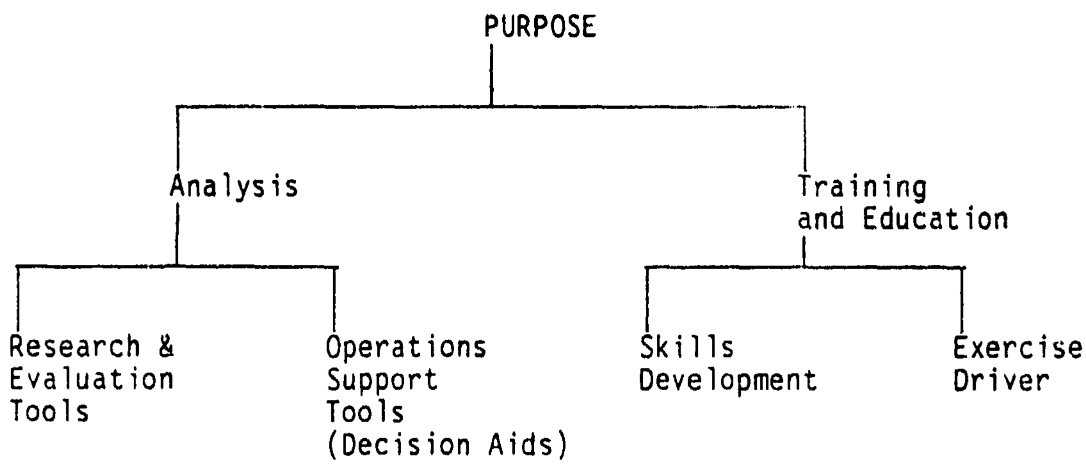

Figure 1. Purpose Taxonomy

A model used as an operations tool would support the decision making elements of operations, resource management, and support operations. In this category models find use as decision aids. Examples include automatic inventory reorder models or weight and balance models for loading aircraft.

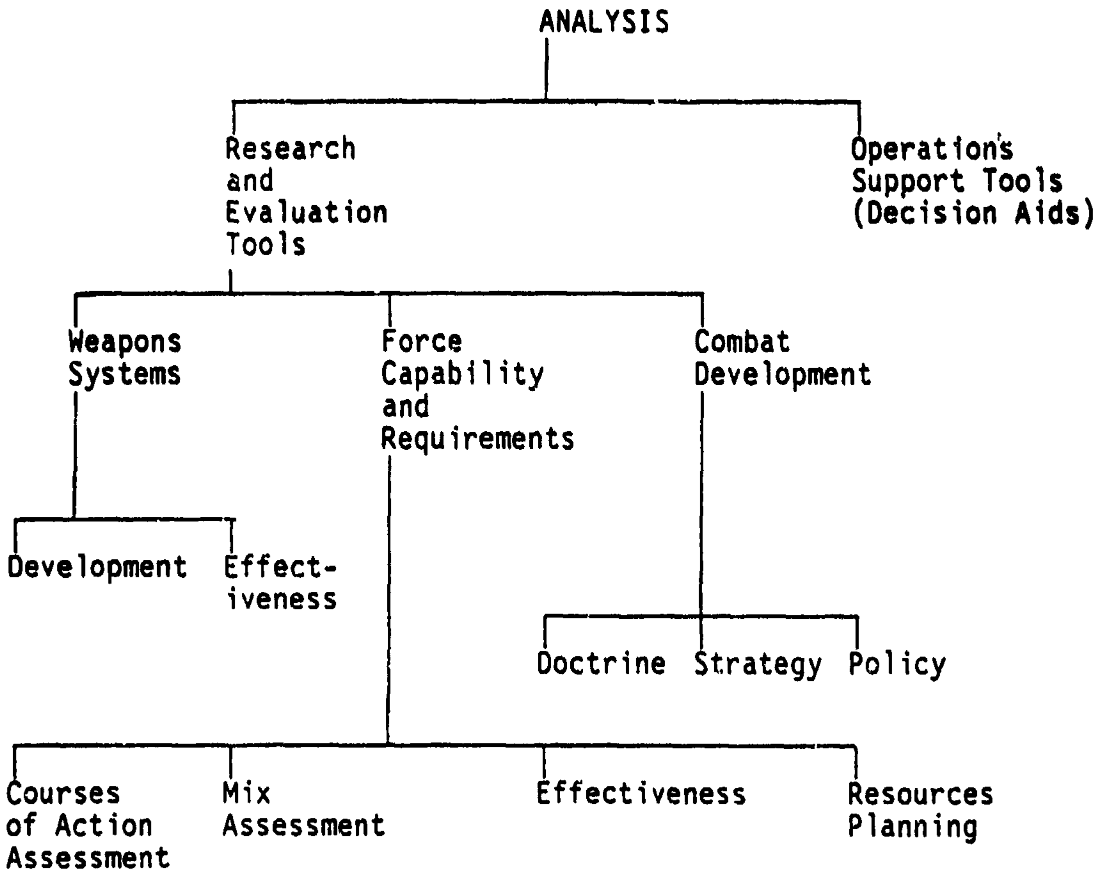

Figure 2. Analysis Expanded

Another broad *purpose* of conflict models and simulations is training and education. The subdivisions of this dimension are Skills Development on the one hand and Exercise Drivers on the other. These two categories can be further subdivided as illustrated in figure 3.

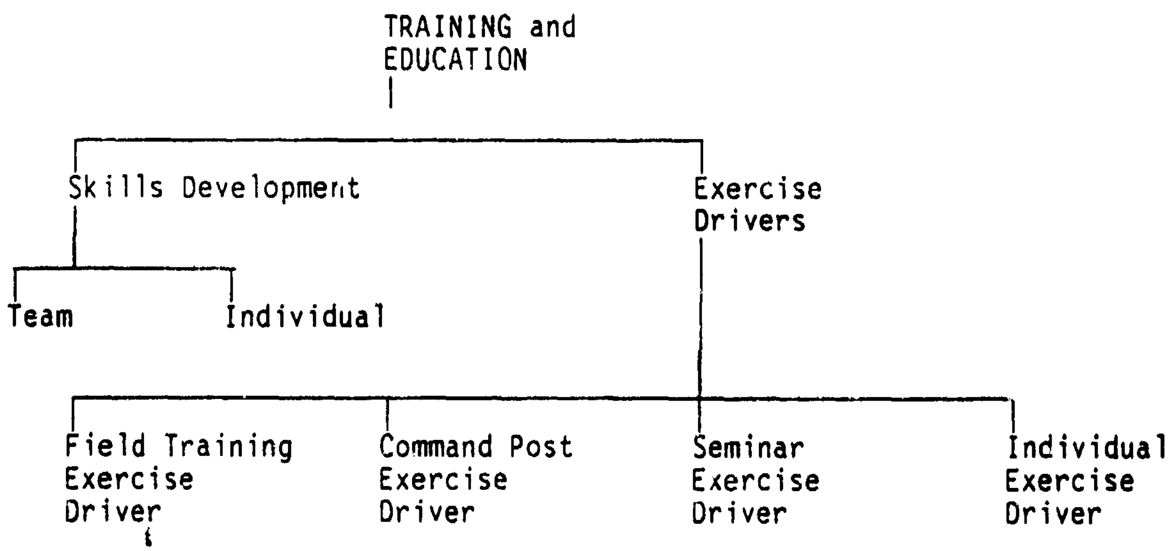

Figure 3. Training Expanded

The boundary between training and analysis is gray, and a guideline to differentiate between training and analytic uses of warfare simulations is useful. The authors believe military men, when not fighting in a war, seek to improve their own and their troops' proficiency in the conduct of war, or (and) they seek a better understanding of war. The former we call training and the latter we call analysis. In general, if the *purpose* of using a model is to transfer or reinforce a lesson or relationship that is already known, then the *purpose* is training or education. On the other hand, if the model is used to discover, deduce or expand relationships or lessons, then the *purpose* is analysis.

By these guidelines, if a commander uses a model to sharpen his command's skills or to teach subordinates some lesson, then the model is used for training and education. If, however, the commander uses the model to drive an exercise to explore the merits of alternative courses of action, then the model is being used for analysis. Unquestionably, and this point needs emphasis, many models can be useful for both analysis and training, even simultaneously. That is, a model used to drive a given exercise could be simultaneously used for both analysis and training by the same people.

III. CLASSIFICATION BY QUALITIES

The qualities dimension of a military model are those real entities and processes which the model represents. The following categories were defined and examined by the SIMTAX Workshop.

A. Domain

The physical or abstract space in which the entities and processes operate. The domain can be land, sea, air, space, undersea, a combination of any of the above, or an abstract domain, such as an n-dimensional mathematics space, or economic or psychological domains.

B. Span

The scale of the domain, that is global, theater, regional, local, individual. Description of the span is often subjective.

C. Environment

The texture or detail of the domain, that is terrain relief, weather, day, night, terrain cultural features (such as cities or farmland), sea states, etc.

D. Force Composition

The mix of forces that can be portrayed by the model, that is, combined forces, joint forces, component, element, etc. Processes such as logistics, communications, and intelligence as well as the composition of force entities work together to determine the force composition abilities of the model.

E. Scope of Conflict

The category of weapons, that is, unconventional, conventional, chemical, biological, nuclear, chemical-biological-nuclear, special, rear-area (either red or blue).

F. Mission Area

Recognized combinations of weapons and procedures used to accomplish a specific objective, that is, sea control, close air support, airlift, indirect artillery, etc.

G. Level of Detail of Processes and Entities

This category of the *qualities* dimension has two components: entities and processes. Regarding "entities", "level of detail" answers the questions, what is the lowest, discrete entity modeled (e.g. numbered air force, air division, wing, squadron, flight, individual aircraft; army, corps, division, brigade, battalion, company, platoon, squad, soldier; individual tank, tank-platoon, tank-company, etc., or individual ship, battle group, task force).

"Processes" affect entities. Attrition, communications, and movement are examples of processes. Processes have a level of detail by which they are described. For example, the attrition processing may be defined in shot-by-shot detail or as a generalized percentage reduction in a unit's resources as a consequence of coming in contact with an opposing unit.

The level of detail of an entity can vary within a model depending upon which process was acting on that entity. For example, armored vehicles might be represented as individual vehicles for attrition purposes, but might disappear as individual vehicles and receive orders to move as a larger unit such as an armored division. Description of the level of detail of a model must contain qualifiers addressing the processes in the model. (For a more detailed discussion of Level of Detail, including a mathematical description of Attrition calculation see Appendix A pages A-19 through A-25. For a graphic depiction of this concept see Figure 8.)

While the workshop listed several discrete categories of entities and processes which military models represent, the authors of this paper are sure the workshop did not examine all possible entities and processes. The authors hope their readers suggest additions to the Qualities dimension (through MORS), and, of course, welcome any suggestions for improving the taxonomy. The form at appendix B can be used for these purpose and also for testing the taxonomy.

IV. CLASSIFICATION BY CONSTRUCTION

Construction defines the design of the model. There are four major categories in the *construction* dimension:

A. Human Participation

The extent to which a human presence is allowed or required to influence the operation of the model. The two major divisions of this category are "required" and "not required." Each branch can in turn be further subdivided as indicated in Figure 4.

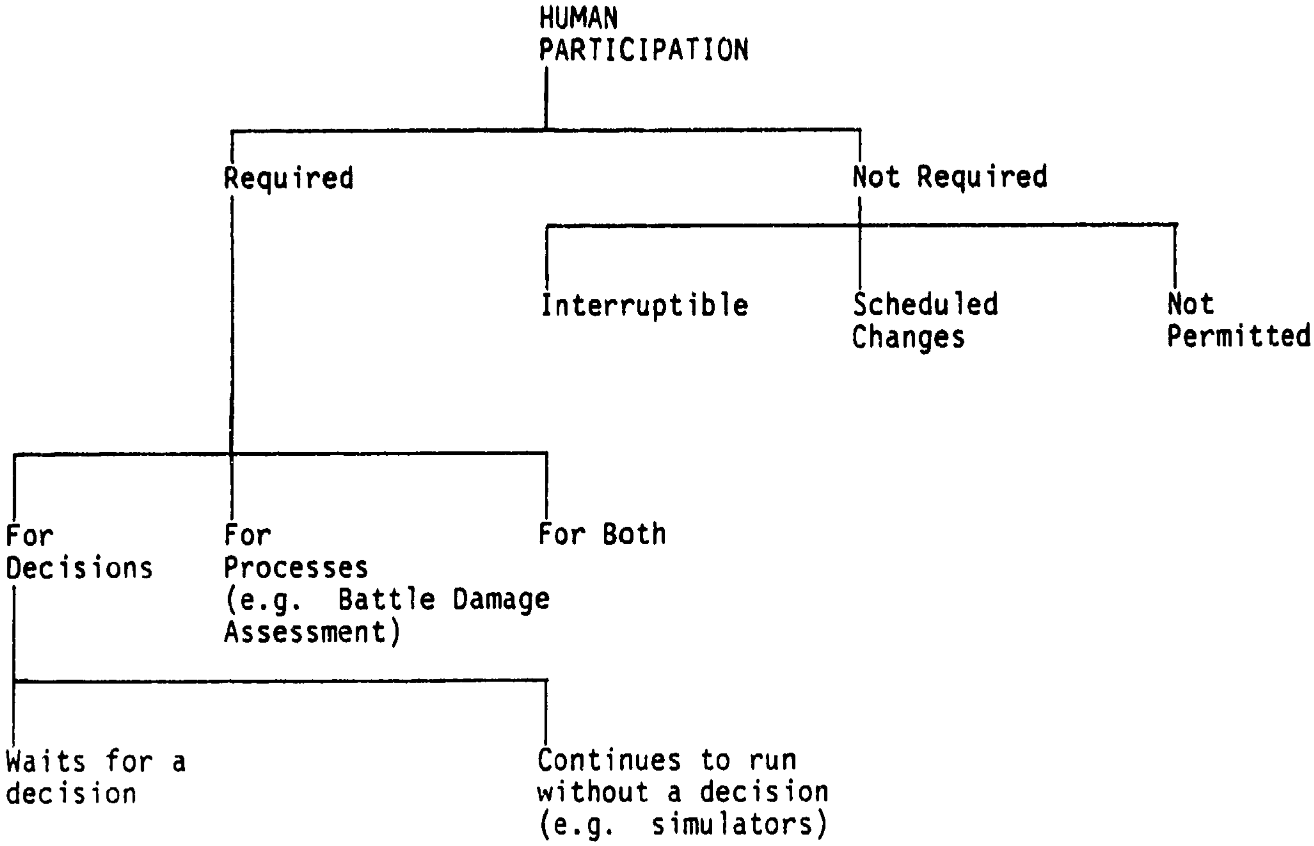

Figure 4. Human Participation

A lengthier discussion of Human Participation can be found in Appendix A on pages A-5 and A-6.

B. Time Processing

The two major divisions of model construction in this category are "dynamic," those models that treat time dependent processes, and "static," those that do not represent a dependence on time. "Dynamic" processes are further divided into "time step", "event step" or "closed form" models depending on the way in which the effect of the passing of time is calculated (see Figure 5).

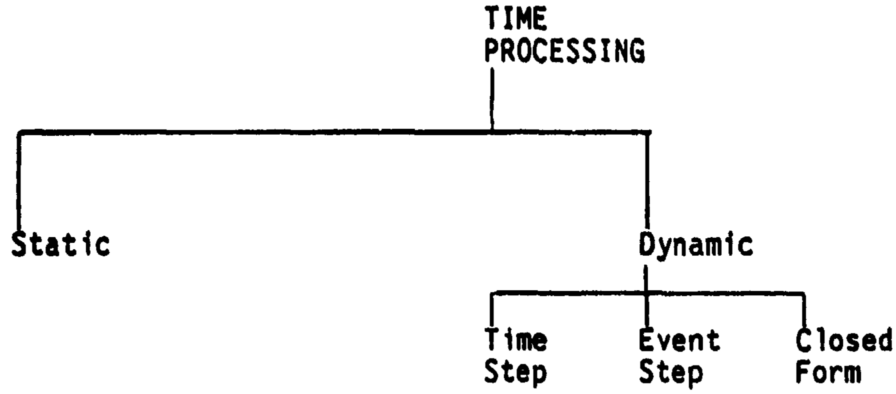

Figure 5. Time Processing

A lengthier discussion of Time Processing, complete with a mathematical description of Dynamic, Closed Form processing can be found in Appendix A pages A-7 and A-8.

C. Treatment of Randomness

Models which acknowledge and represent the possibility of various outcomes of the same event are classified as stochastic. Those models which do not represent variations in outcomes are classified as deterministic. Stochastic models are either Direct Computation or Monte Carlo models. The latter-type models may be Monte Carlo for some processes and not others, but if any part of a model is Monte Carlo the model is classified as a Monte Carlo model. Further subdivisions of each of these divisions are presented in Figure 6.

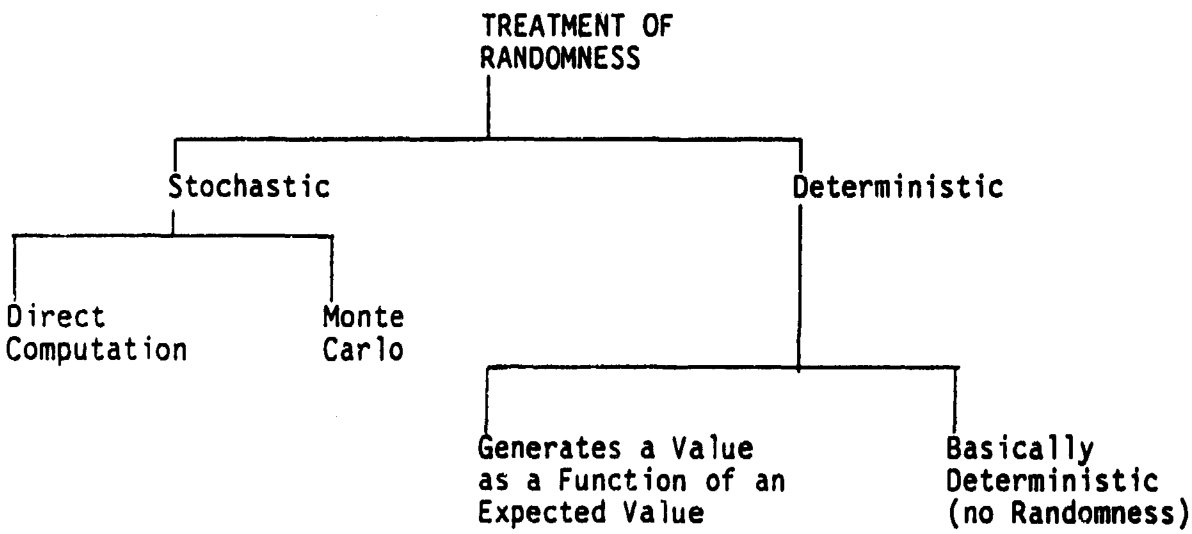

Figure 6. Treatment of Randomness

Randomness is examined in greater depth, including mathematical discussions of deterministic and stochastic processes in Appendix A on pages A-9 through A-13.

D. Sidedness

Refers to the number of collections or alliances of resources working in or through the model toward a common goal. Models are classified as being one, two, or three or more sided. Two sided models are classified as being symmetric, asymmetric, or one side non reactive. See figure 7.

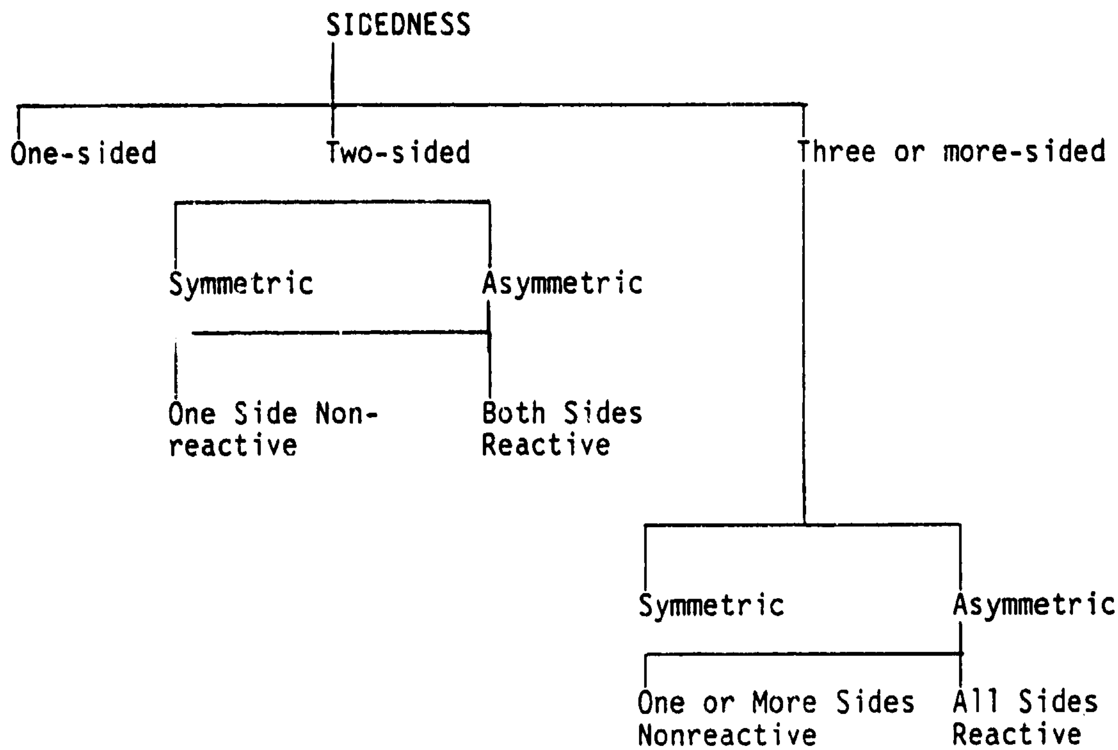

Figure 7. Sidedness

Sidedness is examined in greater depth in on pages A-15 and A-16.

Other categories of useful information dealing with the make up of the model, outside of the construction dimension, could be inserted into a catalogue. For example, one might consider such areas as specific references to documentation (e.g. author, Defense Technical Information Center acquisition number, etc.), programming language, what computers the model can be operated on, what is the speed of a typical run, etc. Catalogue users would also want to know the numeric methodology involved in the model, especially if the numeric methodology were special. Examples might be a linear program, a differential equation representation, or a Markov process, etc. Similarly, prospective users need to know if the model in the catalogue is related to or dependent upon another model. Some models may not be able to operate alone but may require the use of another model to provide inputs or perform "off line" types of calculations. The relationship between the Joint Exercise Support System (JESS) and the Tactical Simulation Model (TACSIM) is an example of this dependence.

V. CONCLUSIONS

The taxonomy described above allows one to classify models in such a way that one could group models by selected common characteristics, and then display in matrix form the voids and duplications in particular aspects of their purpose, qualities, or construction dimensions. For example, Figure 8 is a comparative architecture for three hypothetical models (A, B, and C) that have in common that they were built for the purpose of training and constructed as dynamic two sided, symmetric with human participation models that address the qualities of theater land warfare and can be formed into a framework that displays the level of detail (Division, Brigade, etc.) handled by various processes of interest (attrition, movement, etc.). Voids in this descriptive framework indicate areas in which none of the models with the common characteristics described address the indicated processes acting at the corresponding level of detail. The relationships displayed by these frameworks are of course the design prerogative of the user. There are potentially many descriptive frameworks.

COMMON CHARACTERISTICS

Purpose: training, team, exercise driver
Qualities: theater, land, combined force
Construction: dynamic, two-sided, human participation

VARIABLE CHARACTERISTICS (Processes)

VARIABLE CHARACTERISTICS / Entity Level of Detail	*Attrition*	*Communi-cations*	*Movement*	*Resupply*
*DIVISION**	Model C	Model C	Model A Model C	
*BRIGADE**		Model A Model B		
*Unit Weapon System**	Model A *Model B*		*Model B*	

* See Appendix A, Pg. A-19

Figure 8. Sample Descriptive Framework

APPENDIX A

Methodological Aspects of Combat Modeling

I. INTRODUCTION

Several important methodological aspects of a defense-related model can be characterized in a relatively succinct manner by providing answers to the questions discussed below. Accordingly, the possible answers to these questions can be thought of as giving a type of taxonomy for defense modeling methodologies. Additionally, the brief but consistent approach for characterizing defense models described below can be quite useful in many circumstances, whether or not this method is viewed as a taxonomy for defense models.

The questions discussed below are of one of two forms. For one of the forms, the answers are in terms of "how much of the model is this way," where "this way" is described in the statement of the question, and "how much" is either a numeric measure or a list of representative examples. Questions in this form are called "descriptive questions" below.

For the other form, the questions have multiple choice answers, where the set of choices is defined in the statement of the question. The questions in this latter form are worded in such a way that no more than one answer can apply to any given model. These questions are referred to below as "categorical questions."

However, the people categorizing any given model are encouraged to subdivide the model into parts, where these parts are not necessarily clearly defined (a somewhat vague description would do), but are necessarily collectively exhaustive (which, when appropriate, might be easily done by calling one part "everything else"). This subdivision into parts could be made for some of the categorical questions but not for others and, when it is made, it need not be the same for each question--one subdivision might be more appropriate for one part of one question, a different subdivision could be more appropriate for a different part of that question, and yet other subdivisions could be used for other questions. A categorical question could then be answered for each part of the model as well as for the model as a whole. Some natural subdivisions for some of the questions are stated as part of those questions or are suggested in the discussions of those questions below.

II. HUMAN PARTICIPATION

The first question is the following categorical question: Is human participation required during the running of the model? Models that require human participation are sometimes called interactive or human-in-the-loop models, and may or may not use a computer. Models that do not require human participation are sometimes called fully automated models and, with one set of exceptions, seem to require the use of a computer (the one set of exceptions consists of simple mathematical models that have tractable closed-form solutions). If any portion of the model requires human participation during the running of the model, then the answer here is "yes." Only if the model can (perhaps optionally) be reasonably run with no mid-run human participation is the answer "no."

A. Human Participation Required

1. Decisionmaking Only Versus Decisionmaking Plus Other Aspects Versus Other Aspects Only

If human participation is required, is it required only to make (some of the) decisions that humans would have to make in real combat, or is it needed both for this decisionmaking and for other aspects of the model (such as to represent selected physical processes and/or to provide outcomes for selected combat interactions), or is it needed only for aspects other than this decisionmaking?

2. Continuously Running Versus Pause and Wait

If human participation is required, does the model keep running (in model time"), simulating events as if no decisions were being made (as in a "Space Invader" or "Flight Simulator" type of computer game)[1], or, in at least one place, does the model pause and wait for human input (as in an adventure type of computer game or a chess game with no time limit)? If the model runs continuously in time, can realistic cases typically be run at speeds faster than real time (if so, how much faster?), or only at the same speed as real time, or only at speeds slower than real time (if so, how much slower?).

B. Human Participation Not Required

1. Human Participation Not Allowed

Does the model have the property that, for all practical purposes, not only is human participation not required, it is not even allowed?

2. Human Participation Allowed Through Interruption

A model might have the property that it can be interrupted in some manner (e.g., at a specified time, due to one of a specific set of events, or by a human who is watching the outputs as they are produced and "manually" interrupts the model). For an "interruptible" model, decisions and/or data changes can be included in the processing of the model when it is interrupted. The model can then be started from the point of the interruption. Whether or not a model is interruptible is a categorical type of question requiring a yes-no answer. However, the allowable set of decisions and/or data changes that can be made

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1 In such a case, if the model is run and no decisions are provided by humans, then the model typically provides degenerate outputs and meaningless results. This is in contrast to a model that does not require human participation and so can provide reasonable outputs and meaningful results if appropriately run without human interaction.

requires a descriptive answer. If the categorizer of a model states that the model is interruptible, then it would be useful to give also a brief description of what can and what cannot be changed during the interruption.

3. *Human Participation Allowed Through Scheduled Changes*

A model might have the property that some of its inputs are (optionally) changes to be made to certain data elements or of data to implement certain decisions at particular (model) times during the running of the model. With such a model, a user could run the model, look at the output, and decide that, say, through time t_1 the outputs are appropriate, but at time t_1 the user wants to input a particular decision or change a particular set of data. The user could then schedule this decision and/or data change to be made at time t_1, then restart the model and run it again, perhaps now deciding to accept the results through time t_2 (where $t_2 > t_1$), but to schedule another set of changes to occur at time t_2, and so forth. Like interruption, if the categorizer of a model states that such scheduled changes are allowed, then it would also be useful to give a brief description of what types of changes can and cannot be scheduled.

4. *Both Interruption and Scheduled Changes*

Of course, a model might allow both interruption and the scheduling of changes.

5. *Other Techniques for Allowing Human Participation*

If it is believed that none of the above categories adequately describe a particular model, then that model can be grouped under this "all other techniques" category.

C. Summary

In the sense described above, a model either does or does not require human participation. If the model requires human participation, then either it does so only to represent human decisionmaking, or it does so both to represent human decisionmaking and for other purposes, or it does so only for other purposes. Further, such a model either is a continuously running model or is (in at least one place) a pause-and-wait (for the human participants) model.

If a model does not require human participation, it might preclude such participation entirely, or it might allow human participation by being interrupted, or by allowing scheduled changes, or both (or by other techniques).

III. TIME PROCESSING

As the discussion above indicates, an implicit methodological aspect of combat modeling is how the model treats changes that would occur to the status of resources over time. How a model treats time is a categorical-type of question in the sense described here.

A. Static Models

A static model is one in which the time-phased impact of changes in the states (or status) of resources is not explicitly considered. Such models lack a representation of time.

B. Dynamic Models

Dynamic models are the opposite of static models in that they do explicitly consider the time-phased impact of changes in the states (or status) of resources and they do incorporate a representation of time. In particular, dynamic models explicitly represent the passage of time, which they do in one of three ways: time runs continuously, time is incremented in (constant or non-constant) steps, or time is considered as part of a closed-form solution to a set of equations.

1. *Time Runs Continuously*

As stated above, a model can have the property that it continually simulates the passing of time, perhaps at a speed faster than, or equal to, or slower than the passage of real time, or perhaps at varying speeds.

2. *Steps Through Time*

A model that steps through time can either do so in steps of fixed or independently-determined size--such a model is called a time-step model--or it can build a list of significant (to it) events and, after it simulates one event, it steps directly to the time of the next event, no matter how long or how short that step in time is. This latter type of model (which steps from event to event) is called an event-step (or event-store) model. The terms "time step" and "event step" are defined more carefully below.

a. Time Step

The time step method for representing time in dynamic models is a method in which time is advanced by a fixed or independently-determined amount to a new point in time, and the states or statuses of some or all resources are updated as of that new point in time. Typically these time steps are of constant size, but they need not be.

b. Event Step

The event step method for representing time in dynamic models is a method in which selected events are scheduled in time, time is advanced to the occurrence of the next scheduled event, and the states or statuses of some or all resources (as well as the schedule of upcoming events) are updated at that point in time to reflect the occurrence of that event.

3. *Closed Form Solution*

A dynamic model can also be in the form of a set of differential (or difference) equations, which may have a closed form solution. A closed form solution for representing time in

dynamic models is a method in which the states or statuses of resources are described as explicit and computationally tractable functions of time. Thus, the status of a resource at, say, time t can be found by evaluating the appropriate function at t, without having to simulate combat (either in steps or continuously, as described above) from the start of that combat through time t. For example, given $b(0) > 0$ and $r(0) > 0$, the closed form solution of

$$dr(t)/dt = \begin{cases} -kb(t) & r(t) > 0 \\ 0 & r(t) = 0 \end{cases}$$

and

$$db(t)/dt = \begin{cases} -k'r(t) & b(t) > 0 \\ 0 & b(t) = 0 \end{cases}$$

for $t \geq 0$ is

$$b(t) = \begin{cases} b(0)\cosh\lambda t - \alpha r(0)\sinh\lambda t & t \leq \tau \\ b(\tau) & t > \tau \end{cases}$$

$$r(t) = \begin{cases} r(0)\cosh\lambda t - \alpha^{-1} b(0)\sinh\lambda t & t \leq \tau \\ r(\tau) & t > \tau \end{cases}$$

where

$$\lambda = (kk')^{1/2},$$

$$\alpha = (k'/k)^{1/2},$$

and where τ is given by

$$\tau = (1/2\lambda)\log\{[(kb^2(0))^{1/2} + (k'r^2(0))^{1/2}]/|(kb^2(0))^{1/2} - (k'r^2(0))^{1/2}|\}$$

if this denominator is greater than zero, and by $\tau = \infty$ otherwise.

Few models are this simple, but the ones that are can be important, and they fit into this category.

C. Summary

In the sense described above, a model either is static or is dynamic. If it is dynamic it either processes time continuously, or it does so in steps, or it has a closed form solution. If it processes time in steps, it either does so in fixed time steps or it does so by stepping directly from the time of an event to the time of the next event being simulated.

IV. TREATMENT OF RANDOMNESS

Another important methodological aspect in the construction of a combat model is how the model treats random events. There are two basic approaches here. One is essentially to ignore randomness; this approach leads to deterministic models. The other approach is explicitly to consider randomness in some manner; this approach leads to stochastic models.

A. Deterministic Models

1. *Deterministic Models of Deterministic Processes*

For some processes, it is reasonable to assume that randomness plays an insignificant (or even non-existent) role. Such processes are inherently deterministic and, of course, it is appropriate that models of these processes be deterministic models.

2. *Deterministic Models of Stochastic Processes*

Many, perhaps most, military processes are stochastic, not deterministic, and so case (1) just above does not apply. However, it is possible to construct and use deterministic models of stochastic processes in the following manner.

First, the model is constructed so that resource-related quantities, such as the numbers of particular types of resources at particular locations, the numbers entering particular combat interactions, and the numbers surviving those interactions, are represented in the model by real-valued numbers (as opposed to by integers). For example, the model might account for an initialy input number of aircraft on an airbase, and it might simulate that half those aircraft take off to fly a mission on which a tenth of them are killed due to enemy fire. This is as opposed to simulating particular events, such as that a particular (say, by tail number) aircraft takes off from a particular airbase and then either is or is not shot down by enemy fire.

In a stochastic model, this representation of events by real-valued numbers might lead to the consideration of random variables. For example, the number of a particular type of resources that survive their first combat interaction might be denoted by X. The way that the model processes these survivors might be denoted by the function f, so that the overall output would be the random variable $f(X)$. The expected value of this random variable could be denoted by $E[f(X)]$. However, properties of the random variable $f(X)$, such as its expectation $E[f(X)]$, are essentially impossible to compute in many cases, and so the stochastic approach of attempting to compute $E[f(X)]$ is useless for these cases.

A deterministic model can be used here, however, by replacing all random variables with deterministic quantities, such as their expectations or estimates of their expectations. For example, if the random number of resources surviving a particular interaction is given by the random variable X, then a deterministic model here would ignore the randomness and, instead, replace X by its expected value $E[X]$ (or by an estimate of $E[X]$). Such a model could then process the number $E[X]$ to compute $f(E[X])$. Of course, it is generally not true that $f(E[X]) = E[f(X)]$, but this approach does allow deterministic methods to be used to model complex stochastic processes in a computationally tractable (but not mathematically rigorous) manner.

In short, a deterministic model of a stochastic process is one that ignores the inherent randomness in the stochastic process by replacing all random variables with deterministic quantities (e.g., their expectations) during the running of the model.

B. Stochastic Models

There are basically two types of stochastic models. One uses the Monte Carlo method to produce a set of independent and identically distributed random outcomes. The other directly computes analytic properties of random variables representing those outputs, such as the mean or the whole distribution of those outputs.

1. *Monte Carlo Models*

A Monte Carlo model of a stochastic process produces, for each trial, one realization of the results of that process by drawing (pseudo) random numbers to determine realizations of (one or more) random variables being simulated by that model. Thus, a Monte Carlo model may have many deterministic aspects, and it may replace random variables by their expectations many times, but at least once it does not make this replacement. Instead, at least once it draws a (pseudo) random number to determine a realization of a random variable and it uses that realization as an input to the rest of the process simulated in the model. Each run through all of the processes simulated by the model is typically called a trial. If n trials are run, and if the realization of a random variable, say X, is x_i for the ith trial, then the model estimates the expected value of X, E[X], by

$$E[X] \approx \sum_{i=1}^{n} x_i/n.$$

Clearly, this estimate can be very good for very large values of n, and can be very poor for very small values of n.

2. *Direct Computation*

The concept of a stochastic model that uses direct computation might be best described by giving an example. Picture a model of a combat engagement in which the following holds. There are two sides; however, only the resources on one of the sides can fire at the other side--the resources on the other side are targets only. Suppose that there are M types of shooters on the shooting side, with s_i denoting the number of shooters of type i (i = 1,...,M), and N types of targets on the target side, with t_j denoting the number of targets of type j (j = 1,...,N). Suppose the following:

1) At a fixed time all targets become vulnerable to detection and attack.

2) The probability that a particular shooter of type i detects a particular target of any type is d_i for i = 1,...,M.

3) Out of all of the targets (of all types) detected by a shooter, that shooter chooses, according to a uniform distribution, exactly one to fire upon.

4) Given that a shooter of type i has detected and chosen to fire upon a target of type j, the shooter kills that target with probability k_{ij}, for i = 1,...,M and j = 1,...,N.

5) A given shooter detects targets independently of one another.

6) A shooter detecting no targets does not fire.

7) The detection and firing processes of all of the shooters are mutually independent (so two different shooters can detect, choose to engage, and fire lethal shots at the same target--which results in one target being killed, not two).

Let Δt_j denote the number of targets of type j killed ($j = 1,\dots,N$).

If $M = 1$ and $N = 1$, let $s = s_1$, $t = t_1$, $d = d_1$, $k = k_{11}$, and $\Delta t = \Delta t_1$. Then (for $n = 0,1,\dots,t$) it can be shown that the assumptions listed above imply that:

$$\mathrm{Prob}\{\Delta t = n\} = {}_tC_n \sum_{m=0}^{n} (-1)^{n-m} {}_nC_m[(1-q_t) + (q_t m/t)]^s$$

where

$${}_xC_y = x!/((x-y)!y!)$$

and

$$q_t = q_t(d,k) = k[1-(1-d)^t].$$

Also, if $M = N = 1$, then:

$$E[\Delta t] = t(1-[1-(k/t)(1-[1-d]^t)]^s).$$

For general (integer) M and N, the computation of

$$\mathrm{Prob}\{\Delta t_j = n\}$$

for all relevant n is not tractable; however, $E[\Delta t_j]$ can be computed (for $j = 1,\dots,N$) as:

$$E[\Delta t_j] = t_j(1-\prod_{i=1}^{N} [1-(k_{ij}/u)(1-[1-d_i]^u)]^{s_i})$$

where

$$u = \sum_{j=1}^{N} t_j.$$

This is a very simple model--it only models one engagement and it only allows one side to shoot; but it is a stochastic model that computes results directly, instead of by using a Monte Carlo method. The case in which $M = N = 1$ is sufficiently simple that the entire distribution of the random variable Δt can be calculated. The case for general M and N is too complex to allow direct computation of the distribution of Δt_j, but its expectation, $E[\Delta t_j]$, is readily computed as indicated above.

As this example shows, a model can treat randomness by providing tractable formulas to properly compute relevant quantities associated with the stochastic process being modeled. These quantities might only be the expected values of relevant results, or they might include higher moments, or (as in the $M = N = 1$ case above) they might include the entire distribution. The important point here is that randomness can be directly addressed by stochastic models that do not draw any random numbers and so are not Monte Carlo models. Such non-Monte Carlo stochastic models belong in this "direct computation" category.

C. Summary

The way that one part of a model treats randomness can be (and frequently is) quite different than the way that a different part of the same model treats randomness. Accordingly, this is an area in which it can be useful for the categorizer of a model to subdivide the model into a judgmentally selected set of collectively exhaustive parts, and to categorize these parts separately as to their treatment of randomness.

The question of how a model (or any part of a model) treats randomness is a categorical type of question in the sense described above. Determining the proper category is easy for some cases, but can require a significant amount of understanding and judgment for others.

If any part of a model draws even one random number for use in determining a realization of a random variable (i.e., uses the Monte Carlo method), then that part is Monte Carlo, and if any part of a model is Monte Carlo then the model as a whole is Monte Carlo. It is sometimes tempting to say that a model is not really a Monte Carlo because it draws just a few random numbers per trial and most of the code concerns deterministic modeling, but this is not helpful information since it applies to most (if not all) Monte Carlo models. That is, much of any Monte Carlo model is devoted to aspects other than drawing random numbers. However, if even one random number is drawn, then multiple trials of the model need be run for any statistical validity. Further, if a model draws one or more random numbers and so requires running multiple trials, but treats a particular quantity in a deterministic manner, then it can be quite easy to modify that model to treat that quantity in a Monte Carlo manner and the modified model would be (in general) as easy to run and use as the original. The same statement cannot be validly made about a model that draws no random numbers.

According to this rule (whether or not it draws one or more random numbers), it is easy to classify a model as to whether it is Monte Carlo or not.

If a model: (a) does not draw any random numbers, (b) considers probabilities of various events occurring and/or distributions of various random variables, (c) replaces one or more of the major random variables resulting from these probabilities or distributions by deterministic quantities (such as the expectations, or estimates of the expectations, of these random variables), and (d) makes significant use of one or more of these expectations by further processing of the model, then the model is a deterministic model of a stochastic process.

If a model neither draws random numbers nor considers probabilities of events occurring and/or distributions of random variables because the processes it is modeling can reasonably be considered to be essentially deterministic, then the model is a deterministic model of a deterministic process. However, if a model neither draws random numbers nor considers probabilities of events occurring and/or distributions of random variables, but it could reasonably do so because the process being modeled has inherent and significant stochastic variables, then the model is a deterministic model of a stochastic process as discussed above.

If a model: (a) does not draw any random numbers, (b) considers probabilities of selected events occurring and/or distributions of selected random variables, (c) treats other quantities (if any) as deterministic because these other qualities can reasonably be considered to be essentially deterministic, (d) properly computes selected statistical properties (such as the mean, or the mean plus some higher moments, or the entire distribution) of significant random variables resulting from the probabilities or distributions it addresses, then the model is a stochastic model that uses the direct computational method. However, if condition (c) just above fails because the quantities assumed to be deterministic have, in fact, inherent and significant stochastic variations that, if properly considered, could significantly affect major statistical properties of the results, then the model in question is a deterministic model of a stochastic process.

With this structure, and with some judgment where necessary, models can be classified as belonging to exactly one of the four categories: stochastic models that use the Monte Carlo

method, stochastic models that use direct computation, deterministic models of deterministic processes, and deterministic models of stochastic processes. If a model is subdivided into parts, then each part can also be classified this way. Further, classification of all of its (collectively exhaustive) parts gives the overall classification of the model according to the following rule. If any part is Monte Carlo, then the whole model is Monte Carlo. If no part is Monte Carlo, but one or more parts are deterministic models of stochastic processes, then the whole model is a deterministic model of a stochastic process. If no part is either Monte Carlo or a deterministic model of a stochastic process, and one or more parts of the model are stochastic (sub)models that use direct computation, then the whole model is a stochastic model that uses direct computation. Finally, if all of the parts of the model are deterministic (sub)models of deterministic processes, then the whole model is a deterministic model of a deterministic process.

V. SIDEDNESS

A side in a defense-related model can be thought of as a collection of resources that are being used in cooperation to achieve common goals.

A. One-Sided Models

If all of the resources simulated in a defense-related model belong to one side, then that model is termed a one-sided model here. For example, some logistical models might fit into this category.

B. Two-Sided Symmetric Models

A defense-related model is termed a two-sided symmetric model here if the following three conditions hold: First, each resource simulated by the model belongs (in some sense) to one of exactly two sides. Second, if the model can simulate a particular type of resource (on one side) that can perform a particular set of operations at certain levels of effectiveness for that side, then it also must allow (though, of course, not necessarily require) the other side to possess resources of the same generic type that can perform the same set of operations at the same levels of effectiveness for that other side. Suppose a model can simulate a particular type of interaction between resources of one type (say type X) on one side (say side 1) and resources of a second type (say type Y) on the other side (say side 2). Then by this second condition it must also be able to simulate a type of resource corresponding to X, say X', on side 2 and a type of resource corresponding to Y, say Y', on side 1. The third condition is that, in this case, the model must also be able to simulate that same type of interaction between resources of type X' on side 2 and resources of type Y' on side 1 that it simulates between resources of type X on side 1 and of type Y on side 2.

These conditions might sound quite restrictive. However, in practice, they may not be unduly restrictive in that models tend either to satisfy all three conditions or to be fundamentally asymmetric in that they are quite far from satisfying these conditions. Accordingly, it can be informative to know whether or not a model is a two-sided symmetric model in the sense described here.

Again, it should be noted that allowing symmetry in the modeling of weapons and their operation does not mean that this symmetry occurs in any particular run of the model. Asymmetrical data can be (and usually are) used to model asymmetric scenarios. Symmetry of the model only means that the model is sufficiently flexible to optionally allow either side to use a particular set of weapons systems and/or tactics if the model allows the other side to use similar weapons systems or tactics.

C. Two-Strike Strategic Models

Before discussing two-sided asymmetric models, it is useful to distinguish an important class of models that have the properties that they are two sided and asymmetric, but (in a sense) are conceptually akin to two-sided symmetric models. This special class of models consists of two-strike strategic models.

Two-strike strategic models are, in general, asymmetric in that the first striker can fire at a combination of both value targets and force targets, while the second striker generally can only return fire (with whatever force it has remaining) against the first striker's value. However, there is an essence of symmetry here in that both sides are firing at the reasonable set of targets that they face--it is just that the reasonable set of targets for the second striker consists only of the first striker's value.

One-strike strategic models are clearly asymmetric and belong in the class of two-sided asymmetric models discussed next. Multiple (three or more) strike strategic models are relatively rare and can be adequately categorized by dividing them into those are purely symmetric (each strike, when it fires, can fire at any combination of remaining enemy resources) and those that are not symmetric.

D. Two-Sided Asymmetric Models

If a two-sided defense-related model is neither symmetric (in the sense described in Section 2 above) nor is a two-strike strategic model, then it is termed a two-sided asymmetric model here. Two-sided asymmetric models can be further subdivided into two types: nonreactive and reactive.

1. Nonreactive

A two sided defense-related model is termed nonreactive if one side is firing at the other and the other side is neither firing back nor taking any action to prevent being detected or hit, or to mitigate damage in any way. That is, if (in the model) the fired-upon side can only be doing whatever it would otherwise have been doing had it not been being attacked, then the model is nonreactive.

2. Reactive

A defense-related model is reactive if it is a two-sided asymmetric model but is not nonreactive in the sense just given. For example, all two-sided asymmetric models in which each side can shoot at the other in some manner are reactive models as defined here.

E. Three or More Sided Models

Other defense-related models, such as models that simulate three or more distinct sides, fit into this category.

F. Summary

With the structure presented above, all defense-related models belong to exactly one of the following categories: one-sided, two-sided asymmetric (other than two-strike strategic), two-sided two-strike (asymmetric) strategic, two-sided symmetric, and other. Accordingly, the question of sidedness is a categorical-type of question. As indicated above, it can be useful for a categorizer of a model to subdivide the model into collectively exhaustive parts for such categorical questions, and this comment certainly applies here. For example, a model may be two-sided symmetric in all respects except for the way that it models decisionmaking, or except for the way that it models logistics, etc. In such cases, the model as a whole would be two-sided asymmetric, but major parts of it might be two-sided symmetric. A categorizer who is willing to divide the model into parts could point this out by classifying the sidedness of each of the parts as well as classifying the model as a whole.

VI. NUMBERS OF RESOURCES INVOLVED

Some two-sided models are reasonably characterized as being one-on-one models; e.g., one-on-one duels. Others can be characterized as being few-on-few models in that the number of major resources on each side must be some reasonably small number, say less than or equal to six. Still others can be many-on-many in that the model can simulate more than, say, six major resources on each side. (Note, what is being considered here is the total number of major resources being simulated, not the number of types of resources.) Major resources here should be taken to mean weapons systems such as ships, aircraft, or armored vehicles (as opposed to munitions for these weapons systems). This structure can be made into a set of categorical questions as follows.

A. Numbers of Resources in One-Sided Models

If the model in question is a one-sided model, is the maximum number of major resources that it can simulate on that one side given by: (a) one, (b) 2 through 6 (i.e., few), or (c) 7 or more (i.e., many)?

B. Numbers of Resources in Two-Sided Symmetric Models

If the model in question is a two-sided symmetric model, is the maximum number of resources that it can simulate on each side given by: (a) one (i.e., one-on-one), (b) 2 through 6 (i.e., few-on-few), or (c) 7 or more (i.e., many-on-many)?

C. Numbers of Resources in Two-Strike Strategic Models

If the model in question is a two-strike strategic model, then it probably is a many-on-many model in that 7 or more major resources can be simulated on each side. Simply to allow for other possibilities, such a model can be categorized as being either (a) many-on many, or (b) something else.

D. Numbers of Resources in Two-Sided Asymmetric Models

If the model in question is a two-sided asymmetric model, then is the maximum number of resources that it can simulate on the "larger or equal" side followed by the maximum number it can simulate on the "smaller or equal" side given by: (a) one-on-one, (b) few (2 to 6)-on-one, (c) many (7 or more)-on-one, (d) few-on-few, (e) many-on-few, or (f) many-on-many?

E. Numbers of Resources in Three or More Sided Models

If the model in question simulates three or more sides (in the sense given above), then is the maximum over all sides of the maximum number of resources that it can simulate on a side given by (a) one , (b) 2 through 6 (few), or (c) 7 or more (many)?

VII. LEVEL OF DETAIL

In contrast to the categorical questions above, it seems better to structure level of detail questions in a more free-flowing descriptive form.

Questions concerning level-of-detail can apply to: (a) the types of resources that are simulated and the characteristics of these resources that are addressed, (b) the method of accounting for these resources, (c) the structure by which these resources are modeled, and (d) the structure in which these resources are located.

A. Types and Characterization of Effectiveness of Resources

The first descriptive question here is: What are some representative entities (systems) that are characterized by distinct effectiveness parameters in the model; and, for each such entity, what is an estimate of the number of parameters that the model uses to represent the effectiveness of that entity?

Some examples of entities that might be assigned distinct effectiveness parameters in a model of conventional combat are given in Table A-1.

In determining an estimate of the number of effectiveness parameters that the model uses for an entity, the following points should be noted. First, pure descriptors (like an entity's name or organizational attachment) should not be counted as effectiveness parameters. Second, characteristics of entities that, in reality, might affect the capabilities of a system, but do not do so in the model, should also not be counted here as effectiveness parameters. Third, multiple effectiveness parameters whose only role in a model is in a sum or product with each other should be counted as only one parameter. For example, if a model simulates the effectiveness of an entity by giving it a probability of detection, d, a probability of acquisition and fire given detection, a, a probability of hit given acquisition and fire, h, and a probability of kill given hit, k, and if the only places that d, a, h, and k are meaningfully used in the model is in the product $p = dahk$, then this entity is being described by one effectiveness parameter here, not four. As another example, if a model simulates the effectiveness of an entity by giving it an anti-personnel firepower, p, an anti-truck firepower, t, an anti-light armor firepower, i, and an anti-heavy armor firepower, h, and if the only places that p, t, i, and h are meaningfully used in the model is to determine the overall firepower of the entity by the formula $f = p+t+i+h$, then this entity is also being described by one effectiveness parameter here, not four.

B. Accounting for Resources

The entity structure used in a model for characterizing the effectiveness of resources need not be (and, in general, is not) the same as the structure used by the model to account for the resources themselves, and either one or both can differ from the structure used by the model to move resources. In particular, different entries in Table A-1 can be considered as giving different examples of entities that might be used to account for resources or to move resources. Some additional hypothetical examples are given in Section D, below, after structures to account for resources are discussed here and structures to move resources are discussed in Section C.

There seem to be five typically used methods to account for resources in models, and different resources can be accounted for using different methods in the same model. These five methods are as follows.

First, weapons systems can be accounted for individually. For example, a model could

Table A-1. EXAMPLES OF ENTITIES THAT A MODEL OF CONVENTIONAL COMBAT MIGHT CONSIDER

Entity Described	Army Examples	Navy Examples	Air Force Examples
1. Typical Groups of Weapons Form an Entity	Armored Divisions or Battalions	Generic Task Forces or Surface Action Groups	F-15 Squadrons or Flights
2. Particular Groups of Weapons Form an Entity	Particular Divisions or Battalions	Particular Task Forces or Surface Action Groups	Particular Squadrons or Flights
3. Weapons in the Same Generic Class Form an Entity	Armored Vehicles or Tanks	AAW Ships or Escorts in General	Aircraft or Fighters
4. Weapons of the Same Type Form an Entity	M60s, or M60A1s and M60A3s	CG-47 Class Ships and DDG-2 Class Ships	F-15s and F-16s
5. Each Particular Weapon is an Entity	Individual Tanks	Individual Ships	Individual Aircraft

account for each tank, each ship, or each aircraft individually, knowing whether that particular weapons system is undamaged, damaged, or destroyed and, if not destroyed, where it is located.

Second, a model could account for numbers of weapons systems by type of system and by individual unit the system belongs to, but not by individual system. For example, a model might distinctly account for each battalion being simulated, knowing where that battalion is located and how many weapons systems, by type, are in that battalion (as well as how many systems belonging to that battalion have been damaged or destroyed); but it would not distinctly account for each individual weapons system in any particular battalion.

Third, a model could account for numbers of weapons systems by type of system, but not by individual system and not by individual unit that the system belongs to. For example, a model could account for the numbers of tanks, or of M60s, or of M60A3s, that are undamaged, damaged, and destroyed, and how many are located in a general area; but not how many tanks belong to any particular unit, not how many tanks belonging to any particular unit have been lost, not which particular tanks have been lost, and not where any particular tank is located.

Fourth, a model could account for groups of weapons systems by particular unit, but not either by particular system or by type of system within that unit. For example, a model could distinctly account for each battalion being simulated, knowing where that battalion is located and (say) how much firepower (according to some aggregated measure of firepower) is currently possessed by that battalion, but not which particular weapons or types of weapons are currently providing that firepower for that battalion.

Fifth, a model could account for groups of weapons systems by generic types of units, but not by particular unit nor by particular weapons or types of weapons with that generic type of unit. For example, a model could account for the number of armored battalions and the number of mechanized infantry battalions, how many battalions of each type are in each general location and knowing the average firepower of each type of battalion in each location, but not the location or firepower of any particular battalion and not which particular weapons or types of weapons are providing that firepower.

Of course, other (less frequently used) accounting methods are possible.

The descriptive question here is to estimate how many (either in terms of absolute numbers or of percentages or both) of the resources simulated in a model are accounted for by each of the five methods (or by "other") as described above and, if a mix of methods is used, to briefly describe which resources are accounted for by which method.

C. Movement of Resources

Clearly, resources cannot be moved using structures that are more detailed than the structures used to account for these resources, and resources can always be moved using the same structure as the structure used to account for them. However, resources can sometimes be moved using structures that are more aggregated than the structures used to account for these resources. In particular, the following ways to move resources can be considered.

First, if resources are accounted for individually, then they can be moved individually.

Second, if resources are accounted for either (a) individually, or (b) by type within particular units, or (c) by particular units but not by individual type of resource within these

units, then they can be moved by moving particular units. That is, if individual units are distinctly accounted for, then resources can be moved by moving those units (whether or not resources are either accounted for or can also be moved using other structures).

Third, if resources are accounted for by type of resource but not by type within a particular unit, then they can be moved by type. For example, a model that accounts for tanks in reserve and tanks in combat might (attempt to) move tanks so that a ratio of two tanks in combat for each tank in reserve is maintained.

Fourth, if resources are accounted for either (a) by type of resource , but not by type within a particular unit, or (b) by type of unit but not by particular unit and not by particular weapon or type of weapon within those types of units, then resources can be moved by moving units by type of unit. For example, if a model accounts for the number of armored battalions in reserve and the number in combat, then resources can be moved from reserve to combat in the model by decreasing the number of armored battalions in reserve by one and increasing the number of these battalions in combat by one.

Again, other (less frequently used) methods for structuring movement are possible.

The descriptive question here is to estimate how many (either in terms of absolute numbers or of percentages or both) of the resources simulated in a model can be moved by each of the four methods (or by "other") as described above and, if a mix of methods is used, to briefly describe which resources can be moved by which methods.

D. Some Hypothetical Examples

A model that distinctly accounts for each individual battalion being simulated, that measures the effectiveness of these battalions by assigning each a firepower score (which may be degraded through attrition), that moves resources by moving these battalions, but that does not account for or measure the effectiveness of individual systems or types of systems within these battalions is, in one sense, a battalion-level model. Conversely, it might not be considered to be a battalion-level model because it cannot simulate the inner workings of a battalion. Further, if the employment of the battalions in the model can span the width and depth (on both sides) of the theater, and if sufficiently many other resources (such as aircraft) are also represented so that the model can reasonably simulate many days of combat throughout the theater, then the model is, in a sense, a theater-level model.

Now consider a model in which very detailed type of weapons systems (M60A3 tanks, M101A1 howitzers, etc.) can be described by distinct effectiveness parameters, in which weapons are accounted for by these types, not by individual weapons or as being part of particular units, and in which (ground) weapons are grouped into four classes (direct fire weapons, indirect fire weapons, short range air defense weapons (SHORADs), and high/medium altitude air defense weapons (HIMADs)) for the purpose of accounting for movement (i.e., 67% of direct fire weapons and SHORADs, 90% of indirect fire weapons, and 60% of HIMADs are to be in combat, the rest are to be in reserve). Such a model in some senses (such as weapons effectiveness) is more detailed than the battalion-oriented model described above, yet is less detailed in other senses.

Finally, consider a model in which individual weapons are distinctly accounted for, but the effectiveness of these weapons must be described in terms of a relatively small number of weapon types that can be given distinct effectiveness parameters, and in which the (ground) weapons must be assigned to particular divisions and the only way to move these weapons is to move their divisions. Then, in some sense, this model is more detailed, in other senses it is in-between in detail, and in still other senses it is less detailed than the other two models

described above.

The point of these hypothetical examples is not that any of these types of models are necessarily better, more aggregated, more useful, more detailed, worse, less aggregated, less useful, or less detailed than the others. Instead, the point is two-fold. First (and less importantly), a particular model can treat different structural aspects (effectiveness, accounting, movement) at very different levels of detail. Second (and more importantly), it may not be possible to usefully define level of detail (or of aggregation) in a few words. If the concept of level of detail is sufficiently important to merit consideration, then it may require careful and somewhat extensively structured consideration.

E. Locations of Resources

As portions of the discussion above indicate, another aspect of the level of detail of a model concerns the structure that the model uses to represent the location of resources. In some reasonable sense, all resources can be located in two dimensions. Aircraft (including helicopters), submarines, and missiles also can be located in the third dimension.

1. *All Resources (Two-Dimensional Locations)*

a. Generic Structures

There are several structures that models can use to locate resources in two dimensions. Some common structures are as follows:

(1) exact two-dimensional coordinates,
(2) convex polygons (with specific location within a polygon being unspecified) where:
   - (a) the convex polygons are congruent squares,
   - (b) the convex polygons are congruent hexagons,
   - (c) the convex polygons are other types of polygons, perhaps being of varying sizes and shapes (e.g., various sizes of rectangles,

(3) one dimensional subdivisions (into lengthwise or widthwise regions) with no subdivision in the other dimension (and with specific location within a region being unspecified),
(4) no subdivision in either dimension (i.e., locations are not simulated),
(5) other structures.

The descriptive question here is to give how many (either in terms of absolute numbers or of percentages or both) of the resources simulated in a model are located using each of these structures and, if a mix of structures is used, to briefly describe which resources are located by which structures.

b. Approaches that Use Convex Polygons

A second question here concerns only those models that use convex polygons to locate resources. Such models tend to use convex polygons in conjunction with one of two approaches.

In one approach, the polygons are relatively small (indeed, they may be nested inside of larger polygons), they are defined in terms of absolute geographical location (not in terms of locations relative to a line separating the forces on each side), and they are used both to

locate resources and to delineate the geographical characteristics of the areas they contain. Mobile resources can be moved from polygon to any adjacent polygon in order to surround an enemy and/or attack it from more than one direction. Frequently, the polygons used for this approach are congruent hexagons, and so this approach is sometimes called a "hex" approach. However, other polygons could be used--for example, rectangles (be they congruent squares or not), or an alternating pattern of octagons and (smaller) squares. Good automated movement rules (i.e., rules that never use worse decisions for better forces according to meaningful measures of effectiveness) are difficult to construct for models that use this approach. On the other hand, this approach is quite natural for interaction with human participants (e.g., it is frequently used in military board games and strategy-type computer games). Accordingly, models that use this approach tend to require human participation.

The other frequently used approach is as follows. Two (overlapping) sets of polygons (usually rectangles) are defined, where each set covers the area of interest. One set is used to locate forces for combat interactions; the other set is used to determine terrain and to locate fixed resources, such as aircraft shelters. The polygons used to locate forces tend to be relatively large (e.g., ranging from corps wide to theater wide and from fifty to several hundred kilometers deep), they can be defined in terms of locations relative to a line separating the forces on each side (and so they move as this line moves), and they tend to be generally structured like subdivisions of a set of parallel corridors (which run perpendicular to this line of separation). While forces can be moved sideways from corridor to corridor, once in a corridor they can only engage in combat those enemy ground forces across from them in the same corridor. Terrain and fixed resources are delineated using subdivisions of these corridors that are fixed in terms of absolute locations and tend to be finer-grained than the relative subdivisions used for locating forces for combat. Due partly to the corridor structure and partly to other aspects of ground combat, this approach has sometimes been called a "piston" approach when it is used in conjunction with ground combat. In general, this approach is relatively more frequently used in models that do not require human participation than in those that do require humans to make decisions concerning the movement of forces.

Referring to the first approach described above as a hex-type approach (even though polygons other than hexagons can be used) are to the second approach as a corridor-type approach, the relevant question here is, if a model uses convex polygons to locate resources, does it do so using:

(a) a hex-type approach,
(b) a corridor-type approach,
(c) a mix of these approaches, or
(d) some other approach?

2. *Aircraft, Missiles, and Submarines*

Aircraft (including helicopters), missiles, and submarines (as well as any other resources whose location can meaningfully vary in three dimensions) also can be located in the third dimension. Some common structures used are as follows:

(1) exact altitude/depth,
(2) subdivision into altitude/depth regions (with specific location within region remaining unspecified),
(3) no third-dimension used,
(4) other.

The descriptive question applies concerning the third dimension here is directly analogous to the descriptive question concerning two-dimensional locations described above.

VIII. ATTRITION DUE TO ENEMY FIRE

A. Attrition Not Assessed

Many models simulate some resources that are not subject to attrition due to enemy fire in the model. The first question here is to list and/or briefly describe such resources. The rest of the resources simulated (if any) would then be subject to attrition due to enemy fire in the model.

B. A Taxonomy of Attrition Mechanisms

Some resources might be subject to attrition only once per time period due to one set of enemy weapons. Other resources might be subject to attrition in several different interactions with (perhaps) different sets of enemy weapons in each time period. The point here is that whether or not a resource is subject to attrition in a model is a property associated with that resource in that model. However, if a resource is subject to attrition, then how that attrition is assessed can also depend on the interaction (e.g., on the weapons causing the attrition) in question, not just on the resource, and different techniques can be used to assess attrition in different interactions.

The following is a mutually exclusive and (with "other" at the end) collectively exhaustive list of techniques that can be used to assess attrition in each interaction in which attrition is assessed.

1. Monte Carlo Techniques

Monte Carlo models can use Monte Carlo techniques to assess attrition. Indeed, many models are structured as Monte Carlo models primarily in order to allow them to assess attrition in this manner. Typically, such models simulate interactions in which a particular weapons system on one side is engaging a particular resource on the other side and a random number is drawn to determine the outcome of the engagement. Of course, other Monte Carlo structures are possible. For example, if a group of m shooters is engaging a group of n essentially identical targets and if it is postulated (either directly or indirectly) that the probability distribution of the outcome is that exactly i of the n targets will be destroyed with probability p_i (for $0 \le i \le n$), then a random number, r, could be drawn and j targets would be killed if j is such that

$$p_0 + \dots + p_j > r \ge \begin{cases} p_0 + \dots + p_{j-1} & j \ge 1 \\ 0 & j = 0. \end{cases}$$

The taxonomical structure here is that, if a model draws a random number in order to assess attrition in an interaction, then that model is using a Monte Carlo method to assess this attrition no matter what other techniques are used in conjunction with this random draw to determine the attrition.

2. Traditional Lanchester Square (Differential and Difference) Equations

a. <u>Homogeneous Equations</u>

The equations in Section III.B.3 above are the traditional homogeneous Lanchester square equations in their differential equation form. For the purpose of this taxonomy, the analogous difference equation form is also included in this category.

b. Heterogeneous Equations

The traditional heterogeneous Lanchester square equations in their differential equation form can be written as

$$dr_j(t)/dt = \begin{cases} -\sum_{i=1}^{m} k_{ij} b(t) & r_j(t) > 0 \\ 0 & r_j(t) = 0 \end{cases} \qquad j = 1,\ldots,n,$$

and

$$db_i(t)/dt = \begin{cases} -\sum_{j=1}^{n} k'_{ji} r_j(t) & b_i(t) > 0 \\ 0 & b_i(t) = 0 \end{cases} \qquad i = 1,\ldots,m,$$

where m gives the number of different types of Blue weapons and n gives the number of different types of Red weapons involved in the interaction.

As with the homogeneous case, for the purpose of this taxonomy the analogous heterogeneous Lanchester square equations in their difference equation form are also included in this category.

c. Discussion of Homogeneous Versus Heterogeneous Attrition Equations

As a comparison of the equations just above with those in Section III.B.3 indicates, the distinction between homogeneous and heterogeneous attrition equations (whether they be Lanchester equations or not) is as follows. Since they consider only one type of weapon on each side, homogeneous equations are directly appropriate only if there is essentially only one type of weapon on each side involved in the interaction being simulated. Homogeneous equations can be used if multiple types of weapons are involved, but such use requires: (a) adding together all of the weapons to yield a total number of "notional" weapons on each side, (b) averaging the effectiveness parameters to give a single, overall effectiveness of a Blue notional weapon against a Red notional weapon and vice versa, and then (c) prorating the number of notional weapons killed on each side according to weapon types to yield an estimate of the number of weapons of each type that are killed in the interaction. In contrast, heterogeneous attrition equations inherently account for various types of weapons on each side, they can consider distinct effectiveness parameters for each type of weapon on one side versus each type of weapon on the other side (without always averaging these parameters), and they distinctly compute the number of each type of weapon killed on each side.

Heterogeneous equations can be essentially impossible to solve in tractable closed form. However, they can be solved numerically, and they can easily be used as part of a computerized model.

3. *Traditional Lanchester Linear (Differential and Difference) Equations*

a. Homogeneous Equations

The traditional homogeneous Lanchester linear equations in their differential form can be written as

$$dr(t)/dt = -cb(t)r(t)$$

and

$$db(t)/dt = -c'r(t)b(t)\,.$$

Again, for the purpose of this taxonomy, the analogous difference equation forms of these equations are also included in this category.

b. Heterogeneous Equations

The traditional heterogeneous Lanchester linear equations in their differential equation form can be written as

$$dr_j(t)/dt = -r_j(t)\sum_{i=1}^{m} c_{ij}b_i(t) \qquad j = 1,\ldots,n\,,$$

and

$$db_i(t)/dt = -b_i(t)\sum_{j=1}^{n} c'_{ji}r_j(t) \qquad i = 1,\ldots,m\,.$$

Again, for the purpose of this taxonomy, the analogous difference equation forms of these equations are also included in this category.

c. Discussion Concerning Point and Area Fire

It should be noted that no mention was made of point fire or area fire in the discussions above about Lanchester square and linear equations. This can be important because a somewhat commonly held myth is that point fire is somehow inherently related to Lanchester square equations while area fire is inherently related to Lanchester linear equations. In fact, depending on the (perhaps assumed) details of the particular combat being modeled, some types of point fire can be appropriately represented by versions of Lanchester square equations, others by versions of Lanchester linear equations, and still others by other attrition equations, and some types of area fire can be appropriately represented by versions of Lanchester square equations, others by versions of Lanchester linear equations, and still others by other attrition equations. Accordingly, the categorizer of a model here should consider the particular attrition equations being used in the model, not at the rationale (if any) given for the use of those equations.

4. Attrition Equations in which the Number of Targets Killed Is Structurally Independent of the Number of Shooters

All of the types of Lanchester equations discussed above have the property that, if the number of shooting weapons is varied, then (except for degenerate cases) the number of targets killed also varies. An attrition process belongs in the category described in this section if this property does not hold and, instead, the number of targets killed remains constant as the number of shooting weapons is varied. The most commonly used attrition process with this property is the one that assumes that a loss rate (or, synonymously, kill rate or attrition rate) applies, where this rate is not structurally dependent on the number of shooters involved. For example, if a model assumes that the loss rate of a particular resource due to enemy fire is given by an input percentage, then that model should be characterized as being one in which the losses of this resource are structurally independent of the number of weapons shooting at it. Other, more complex examples exist in which losses are structurally independent of the number of shooters involved, and all such should be categorized as belonging here.

5. *Other Attrition Equations*

All attrition equations not covered above are classified here as belonging to these "other attrition equation" category. As with Lanchester equations, these other attrition equations can be subdivided into homogeneous equations and heterogeneous equations.

a. Homogeneous Equations

One commonly used type of homogeneous attrition equation is as follows. A scalar measure of the strength (i.e., combat firepower) of the force on, say, side 1 at the start of a given time period is determined by some means (many different methods can be used). Call this measure of strength s_1. A scalar measure of the strength of side 2, say s_2, at the start of that time period is also determined. The ratio of these strengths, s_1/s_2, is calculated (such ratios are frequently called force ratios). Attrition to the strength of each side during the time period is assumed to be some function of this ratio. That is,

$$\Delta s_1 = f_1(s_1/s_2)$$

and

$$\Delta s_2 = f_2(s_1/s_2).$$

(If this homogeneous approach is being used to simulate attrition of heterogeneous forces, then these losses in strength can be prorated over weapon types to determine losses by type.) Since this approach is somewhat common, it can be useful to further subdivide homogeneous attrition equations here into force ratio attrition equations and all other (non-Lanchester non-force ratio) homogeneous attrition equations.

b. Heterogeneous Equations

Heterogeneous attrition equations can be further subdivided into those that are heterogeneous in types of shooters but not types of targets, those that are heterogeneous in types of targets but not types of shooters, and those that are fully heterogeneous in both types of shooters and types of targets. This subdivision technically can be applied to the traditional Lanchester equations presented above, but it is relatively pointless to do so--if heterogeneity is to be considered at all in Lanchester equations then it might as well be fully addressed. However, there exists other attrition structures in which this distinction can be significant. Beyond making this distinction, it may be better to describe the particular attrition equations involved than to make further categorical subdivisions.

6. *Other Types of Attrition Processes*

Attrition in combat models tends to be calculated either using a Monte Carlo method or using some form of attrition equation. In case neither of these two approaches seem like appropriate descriptions of the attrition processes used in some particular model, this "other types of attrition processes" category is included here for completeness.

C. Summary

This attrition taxonomy is structured so that each attrition interaction in a model can be characterized as being of exactly one of the types described above. Accordingly, an appropriate descriptive question here concerning a combat model is to give the absolute number and/or the percentage of attrition interactions in the model that belong to each of these types and, if a mix is used, to briefly describe which attrition interactions in the model are simulated using which of these types of attrition techniques.

APPENDIX B

TAXONOMY WORKSHEET

TAXONOMY WORKSHEET

Please use this form to classify models with which you are familiar using the taxonomy described in the text and in Appendix A. Use the *Other Descriptor* spaces for additions to the taxonomy or to list good-to-know information that is useful for a catalogue but not essential for classification. Such data might include systems requirements, run time, size (for storage), data bases, model history, frequency of use, time compression, developer, point of contact, set-up time, pre- or post-processors, security classification, staff operating overhead, principal output parameters, and validity.

A. Model Name: ______________________________

B. Model PURPOSE:

Primary: ______________________________

Other: ______________________________

C. Model QUALITIES:

Span: ______________________________

Domain: ______________________________

Environment: ______________________________

Force Composition: ______________________________

Scope of Conflict: ______________________________

Mission Area: ______________________________

Entities: ______________________________

Processes: ______________________________

D. Model CONSTRUCTION:

Human Participation: ______________________________

Time Processing: ______________________________

Treatment of Randomness: ______________________________

Sidedness: ______________________________

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Other Descriptors: ______________________________

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APPENDIX C

SIMTAX WORKSHOP ATTENDEES

APPENDIX C

SIMTAX WORKSHOPS ATTENDEES

Denny F d'Alelio	SYSCON
L Bruce Anderson	IDA
Robert K Beacom	USAF SA
Vernon Bettencourt	ODUSA (OR)
Cecil Black	Boeing
Sylvia Branch	USAF XOXID
Walter W Clifford	USAMSAA
John H Cushman	SYSCON
Trevor Dupuy	Data Memory Systems
Patricia M Fleming	USA CAA
Michael D Flint	CIA
Richard E Garvey, Jr	BBN Labs
Alan L Gropman	SYSCON
Maureen Harrington	AFHRL
George Heinrich	Boeing
Thomas King	AFHRL
Judith C Krebs	USAF SA
Kenneth E Lavoie	USAF CADRE
William G Lese	CENTCOM
Richard Maruyama	TRADOC
Grant Miller	Mitre
George Miller	Vector Research
Gary Morton	Naval War College
Dale K Pace	Johns Hopkins/APL
Dean Pappas	USAF CADRE
Anthony F Quattromani	SYSCON
Thomas M Regan	Atlantic Analysis
Vincent P Roske	Joint Staff J-8
Dudley Schwartz	ANSER
C Parks Shaefer	USAF MAC
W E Sykes	GAO
Matthew J Szczepanek, Jr	USEUCOM
Milton G Weiner	RAND
Kenneth E Wiersema	AMMO
Richard I Wiles	MORS

APPENDIX D

ALPHABETICAL INDEX OF MODELS

ALPHABETICAL INDEX OF MODELS

ALPHABETICAL INDEX OF MODELS
(cont'd.)

ALPHABETICAL INDEX OF MODELS
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